This magazine is published to promote sound thought upon and concerning industrial medicine and traumatic surgery. To that end it will contain articles, news items, reports, digests and other presentations, together with editors' comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

Reg U S Pat Off.

The editors will exercise care in checking on the accuracy of data printed, but in all other respects articles and opinions of which expression is allowed are the opinions of their authors—the editors reserving in all cases the right to comment on the same, in the current or any subsequent issues, as they may be inclined.

The Journal of Occupational Diseases and Traumatic Surgery

The Science, the Law and the Economics of Industrial Health

Volume 6 SEPTEMBER, 1937 Number 9

Observations on Sequels of Head Injury

— Especially in Children —

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FOR the better understanding of head injuries, those who have to deal with children may be benefitted in knowing more about similar conditions in adults; the general and the industrial physician and surgeon need to know about these conditions in children, for in children some conditions are more clearly perceived and thus better understood.*

The head injuries which so often bring children to our attention have been most frequently from automobile accidents, and of those cases the preponderance were passengers in automobiles in collision and not pedestrian children struck by automobile vehicles. The next largest group were children who had incurred head injury at or about birth.

Of the adolescing and post-adolescing girls who had head injuries most of them were pretty and were guest passengers in the front seat: they had facial lacerations which seriously marred their beauty as well as frontal brain injury which robbed them of mental reliability.

What price beauty?

What price speed?

For in the case of these girls the almost universal cause of the accidents was show-off speeding. Girls from 14 to 24 should be taught the "rabbit punch," tattoo of fists beating the menacer's neck behind, and thus be able to control an unreasonable driver-companion.

Sequels of Frontal Head Trauma

HEAD injury here means sudden trauma with subsequent unconsciousness, delirium, and asthenia, whether or not there is demonstrable skull fracture.

Frontal here is used in contra-distinction to occipital, hence frontal here includes fronto-temporal and fronto-parietal.

After the hospital phase and surgical treatment, and after what is assumed to be adequate convalescent time, head injury cases are returned to duty. Duty, for children of school age, is school.

Over half of such cases when later seen are well physically, well mentally, and well emotionally.

However some cases of head (and brain) injury have persisting sequels. These sequels bring them to the attention of the educator if the patient is a school child, and to the attention of the physician, consultant, or family physician, and may bring them to a neuro-psychiatrist.

Such sequels fall into two categories, one neurological and the other mental. The neurological ones are further subdivided into focal and general.

Focal symptoms are easily recognized, e.g., athetosis; paralysis, especially of the cranial nerves; paralysis and atrophy of a limb. The general neurological symptoms of head pains (not head aches) and dizziness frequently induced by change of position, such as stooping over, or even on first sitting up on rising, easy fatigue, sudden flushing or blanching of the face when sitting still or in very moderate exertion and followed by an attack of head pains, are all well known.

The mental symptoms of mental fatigue, mental inefficiency, unreliable memory, and emotional instability are found in many scientific articles on residuals or complications of brain injury.

What is reported here is in addition to what has been stated elsewhere and is what we have found in clinic cases and in private cases.

Effect of Low Barometer: Diminished Receptivity

ON LOW barometer days there is such a profound diminution of receptivity that there is subsequently a defect in the memories for what occurred, or was said to, or presumably but falsely was believed to have been taught to, the child.

Assume a child was nine years old when his head was injured and that he returned to school when he was 10, and assume that in school then he was taught fractions and was taught punctuation, e.g., hyphens and paragraph structure. On a low barometer day he was taught (sic) adding fractions of dissimilar denominators and was taught the difference between words like New York, Newark, New (at the end of a line) York, New- (at the end of a line) ark; or perhaps he

* Appendix to the Eighth Annual Report, Gary Child Clinic, 1937.

was taught (sic) the recognition, use, and significance of the apostrophe (or "possessive mark" as some children call it, and thus limit their concept of it). Arithmetic has reviews and is a step-by-step process making frequent use of previous learning, and is exact R or W; whereas reading is progressive and more largely assumes rather than demonstrates that what was once taught was learned.

Failure in receptivity is more easily caught in arithmetic than in reading; failure of learning a process in arithmetic is capable of correction before a week has elapsed.

At least that is my hypothesis to explain why so often we have noted that head injured children have no arithmetic defect but do have a spotty reading defect. This defect becomes obvious only after a lapse of three or four, usually four, years.

Something comparable occurs in social development.

Assume that boys at the age of nine reach the conclusion that it is smart to "swipe" things, become clever and adept at 10 and 11, but at 12 outgrow that habit pattern and accept the more mature ethical standard that it is manly to be trustworthy.

A boy who at nine incurred a serious head injury will be found at 12 to be an "inexcusable" thief, and "because he is grown up no allowances can be made for him." Belated conduct development is very, very common in head injury cases in childhood. My explanation is that there are, in the years following the head injury, many, many days of poor receptivity to the maturing talk of other children. Boys of 12 and 13 when injured, if they have sequels, especially this sequel of poor receptivity on low barometer days, are not popular with their age mates when they are 16 or so.

Not introverted, they do become seclusive by exclusion.

Effect of Low Barometer: Immature Judgment

ALSO on low barometer days there is defect of judgment which can be described as a temporary regression to more juvenile judgment.

An interesting but not atypical illustration is a boy of 14 who finally was given a new bicycle. His father told him to take it from the back porch and uncrate it in the back yard. He took it to the yard, tore off the crate boards and slats, turned them against the wall of their wooden garage, put on the handle bars and saddle and pedals, and then set fire to the pile of rubbish, paper, excelsior, and slats. The garage of course was set afire from the bonfire against it. It was a low barometer day. His judgment then was that of an eight or nine year old.

Other examples are the relatively immature judgment as well as increased physical sensitivity to new bumpings of the head of children who previously had had serious frontal head injury when those children try out in athletics but fail in team work.

If this condition is so in children, who are transparent, are these not the logical explanations of the industrial failure of adults? So few workmen who have had serious head injury with sequels become foremen, or even continue with success at their work, or in supporting their families and being compatible with them. The technic of industrial work increases in complexity, and to each new complexity everyone must ever be keenly receptive. Foremanship, like leadership in family life, needs ever-maturing judgment.

Treatment

TREATMENT in these late stages after a year or more after the accident is divided into two parts: chemical, and prevention of aggravation.

The recommended chemical treatment, in order of importance, consists of phosphorus, of acceptable hydrocarbons, of vitamin D, and of vitamin B.

Let this be clearly understood: in our experience at least, haliver-viosterol or other CLO (cod liver oil) concentrate is very definitely contra-indicated in these cases whose fatigability is a life-saving or life-protracting defense mechanism of Nature.

Such cases should not be energized, at least unless they are so over-nourished that they do not have to draw on their own reserves. When a child is tired we should not assume that his mind and muscles are all that are tired, but we should assume that all the physiologically functioning organs and systems of him are tired. When tired, such a child should be nourished and not further energized.

Phosphorus is a difficult substance to prescribe effectively. Yellow phosphorus is toxic, red phosphorus is inert but may be given in one-grain doses, phosphates like glycerophosphates have little benefit in doses given, and already conjugated phosphates like calcium phosphates have the phosphorus already fixed, hence are not suitable for phosphorus medication where it is intended that the phosphorus be available for tissues, especially impaired tissue. Clinically these two methods have been found useful in sequels of brain injury and brain atrophy, whether after trauma, or after apoplexy, after courses of tryparsamide and malaria in paresis, in cerebral arteriosclerosis, in senile atrophy, and in alcoholic brain impairment:

1. Yellow phosphorus in cod liver oil, preferably in CLO and malt emulsion[1], and
2. Red phosphorus in one-grain pill doses[2] taken 40 minutes after taking one teaspoonful of CLO. Such medication twice or thrice a day, most days.

The best hydrocarbon is uncooked fats preferably oily CLO or CLO emulsion but never the CLO extractives rendered devoid of oil. CLO emulsion with maltose contains vitamin D which clinically is helpful in phosphorus medication and contains extra and assimilable nourishment in the maltose. An ideal compound would be larger doses of phosphorus, such as red phosphorus in CLO, where all the fat and all the vitamin D were retained but much of the vitamin A was removed, and in an emulsion with the simplest of all sugars, glucose-dextrose, suitably flavored.

Vitamin B given separately, B_1 from rice polishings, does relieve intracranial neuritis when the etiological cause has subsided or is remote. Given

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1. Borchardt's Malt with CLO and Phosphorus, Chicago.
2. Sharp and Dohme Pill Phosphorus Amorphus, list number 275, Philadelphia.

over a course of many months and gradually tapered off, clinically it has been found a helpful and necessary adjuvant.

There is not now or yet available a vitamin D and B compound.

On days of severe head pains, dehydration by salts, e.g., sodium phosphate, is more effective than salicylates. The consequences, hemorrhoids and upsets of intestinal rhythm, must be met.

Sequels of Occipital Head-Trauma

CLINIC cases of this nature, confirmed by similar cases seen in private practice and in consultation, show this symptom in common: emotional or mood disorder persisting from awakening. For several years at least there will be an occasional day when the patient awakes sad and blue and melancholy. That mood endures the entire day and can not be modified by environmental stimuli such as encouragement or "cheering up," nor by quietness; can not be modified by medical or psychotherapeutic treatment; can not be modified by appeal to reason, nor by any other means. Such cases, on such days and for such days only, resemble early cases of manic depressive depressions. Rarely will the mood disorder last two or three days.

The same cases on other "bad" days will awake irritable, and all day long will be cross, fretful and angry. They can not be appeased. They may be as irritable as a post-convulsive epileptic. They may be dangerous to others. However on those days they usually retire, shut themselves in the back of the house, and avoid the family.

On other days they may awake fault-finding and petulant and complaining. Their endless flow of conversation is identical with what they said on previous similar days. Past mistakes and inadequacies of others are rehashed, in much the same stream of conversation as some women talk the day before menstruation. Nothing on these "bad" days can be said or done or promised or given to placate them. Or they may be loquaciously egocentric.

In diametrical contrast is their reaction to stress on average or "good" days. Then they awaken without emotional or mood disorder. However if things go wrong and their mood is upset as would anyone's mood be altered, be it depressed or irritable or displeased, the alteration of mood is of short duration and in proper proportion to the provocation, and thereafter for the rest of the day their mood is calm until stimuli cause more reactions which will be normal reactions such as delight, expectancy, sorrow, anger, tenderness, curiosity, or interest, etc. On those days such children learn and can be taught; on those days such adults may work and even do administrative work.

They are, on those days, reliable.

In all these occipital head-injury cases there is no intellectual impairment and no dementia.

I know of no cause of these "bad" days, and I find no correlation with dreams, weather, fatigue, constipation, dehydration or hydration, the previous day's activities or emotions, nor with any factor.

However as the symptoms on these "bad" days or days of emotional fixation resemble one or another kind of organic or functional mental disorder (and believing that there are some organic bases, possibly impaired physiology in sub-standard constitution, in so-called functional cases) I believe that the emotional disorder is the result of previous organic damage to the brain at the time of the head injury and is due to slow-to-reverse organic changes within the brain during the preceding night or during awakening.

For recommended treatment I have found nothing satisfactory, but empirically I prescribe or recommend Vitamin B_1, preferably the impure syrupy B_1 from rice polishings. It seems to ameliorate the severity of the emotional changes. I have no way of estimating if it diminishes the frequency of the moody days. Such patients naturally tend to discontinue treatment and unless insured or employed or in hospitals and homes continuous treatment can not be insisted upon or required.

In my opinion the prognosis in general can not be expected to be good.

Prevention of Aggravation

PREVENTION of aggravation is of almost vital importance. Diathermy or radiant therapy as to the injured neck or back may make the neurological and the mental condition to become progressive. If ever the neck or body must be treated as with infra-red or ultraviolet therapy the once-injured brain must be protected. Radiant therapy directed directly onto the head brought on a painful, pre-suicidal dementia in one case I saw as consultant.

Head-injured cases must avoid bumping the head again (hence the rule of "rubber heels, hand on bannister on walking down stairs, no horseback riding, no ice-skating, no football, no pole vaulting, and no riding in vehicles without good springs").

Heads which have been injured by trauma must be protected thereafter. Heat, such as in a bakery or stoke-hold, or summer sun without a hat, are all to be always avoided. Chilling cold should, not must, be avoided. Therefore all such cases are instructed to wear a hat in winter as in summer.

Poisons are especially poisonous to injured brains, both exogenous poisons like lead or alcohol, and endogenous poisons like influenza toxemia, scarlet fever, typhoid and the "wet nose" type of "cold" (virus "cold" with secondary bacterial infection).

Preventive inoculations are in order in these cases, typhoid vaccines, "cold shots", scarlet fever prophylaxis, etc. Jarring diseases such as pertussis (whooping cough) are to be treated with adequate sedation.

Paranoid from Another Injury

WE reported year before last in the Appendix of the Sixth Annual Report of the Gary Child Guidance Clinic,[1] that heads which have twice been seriously injured are apt to cause a permanent yet atypical paranoid state of mind. This year we had a case of paranoid mentality following head injury: detailed history painstakingly elicited revealed no prior head injury but eventually disclosed a serious birth injury. These twice-injured brains do not respond to any known medical treatment, and such cases

1. In an article on Paranoid Deviation, published in the *Journal of the Indiana State Medical Association*, June, 1936, Vol. 29, No. 6, page 276-280.

are doomed to mental affliction which ostracizes them, and to head pains which make even solitude unbearable.

Ancestral Biological Limitations

APPARENTLY the brain through countless ancestral ages has come to rely on the cranium for protection and has concomitantly come to lose the regenerative ability that skin and bones and muscles and the non-protected parts of the body have so highly developed.

We must assume that, during the years of development of the human race, head injuries were largely of two kinds, inflicted wounds and falls. If the inflicted wound was grave enough to cause unconsciousness that person was thereupon killed, and thus left no subsequent offspring with an inherited ability to convalesce from brain injury. The fall's effect may be estimated and compared with modern high speed automobile accidents.

The contrast between ancient head injuries, which perhaps could be withstood, and modern accidents might be judged by illustrations such as these:

A man of 120 pounds fell 18 feet and landed on a side of his head, and in falling took about a second: 120 lbs. x 18 ft. in a second equals 2,160 foot pounds.

A modern woman of 120 pounds, driving or riding in an automobile at 55 miles an hour, collides with a fixed object: 120 lbs. x 80⅔ ft. per second equals 9,640 foot pounds.

A modern youth of 120 pounds, driving in an automobile at 55 miles per hour, collides with an oncoming automobile approaching at a rate of 45 miles per hour. Each car weighs about a ton. That would be the same as riding in a car going 100 miles an hour striking a fixed object, for 55 plus 45 equals 100. The cars of equal weight would injure each other about the same. His own trauma is 146⅔ ft. per second equals 17,560 foot pounds.

A one-ton automobile at 30 miles per hour hits a child with a force of 88,000 foot pounds assuming that the accident stops the car, but if the child is carried or thrown then the impact is less. As that is the rule, no data may be assumed as to how much or with what force the car and the child impact on each other.

Reviewing: An ancient accident, falling equals 2,160 foot pounds.

A modern collision against a fixed object equals 9,640 foot pounds.

A head-on collision equals 17,560 foot pounds.

A car striking a pedestrain exerts (?) foot pounds or less at 30 miles per hour.

Falling machinery parts in modern industrial accidents fall with more violence than slowly falling trees when they were uprooted and fell on some of our ancestors' skulls: the variables here are too many to offer a commensurable illustration. Skulls are no thicker now than experience in countless ages showed Nature that they needed to be.

Nystagmus and Unusual Reading Defect

ONE unusual case of focal neurological involvement complicating educability illustrates only itself, but is rare enough to be recorded medically.

AB, male, was (?) years old when he suffered a left temporo-occipital head injury with contracoup, deep unconsciousness, delirium, profound weakness, and then asthenic state with frequent attacks of head pains and dizziness. After a year he returned to school. Within a few years it was noted that he had a most atypical reading defect.

Study of his oral reading showed that of wide pages or wide columns he could not read accurately the right end word or syllables, and at his attempt to read on he could not read accurately the word or syllables of the next line attempted. As often as not he missed beginning at the first word or two or syllables of the next line, might restart the line read or the line above it or might drop a line or two to begin. Narrow columns he read continuously with the lines in sequence.

Neurological examination revealed the cause: he had bilateral nystagmus (dancing eyes), and when he turned his eyes far to the right or far to the left without turning his head, his eyeballs jerked and his vision did not fix as intended. Nystagmus is found in blindness and in organic brain disease of one sort or another involving the nuclei of origin of the cranial nerves to the eyeball muscles, and in such cases is permanent. His reading defect is deemed permanent. If such a person were in industry with orders to read, or driving an automobile, or otherwise dependent as much on peripheral vision as ordinary people are who have equivalent good central vision, what failure and what potential catastrophe might ensue!

A similar case of nystagmus with reading defect from inability to read the end word or syllables of sentences printed in broad columns has been observed in a 14 year old child who developed epilepsy from injury to brain at birth.

Conclusions

IN TRYING to understand the sequels of head injury in human beings, some light is shed by studying such cases in adults and more light in cases of children.

2. Following surgical convalescence sequels may persist: neurological, focal, diffuse; mental; and emotional.

3. Low barometer days are characterized by poor receptivity with consequent spotty memory defect.

4. Low barometer days retard social and conduct maturity.

5. On low barometer days there is a temporary retrogression of judgment.

6. Medical treatment consists of phosphorus, oils, certain vitamins, and a high sugar diet.

7. Occipital head trauma leads to days of emotional fixation, which emotion begins on arising and lasts all day.

8. Aggravation from subsequent trauma, irradiation, heat, or poison, must be avoided.

9. Multiple trauma in sequence lead to paranoid mental states.

10. The human skull is not constituted to withstand modern industrial or high speed automobile accidents.

11. A case history is quoted of post-traumatic nystagmus with reading defect from inability to fix the vision at the beginning and ending of printed lines.

A Plea - in Fractures

—For Better First Aid and Transportation Facilities—

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IN FORMER decades, the railroads furnished a large percentage of fractures and extensive injuries.* Safety devices, better working discipline, and safety rules and meetings, however, have markedly reduced injuries of railroad employees. But the streets and highways, congested with fast moving motor cars, often with inexperienced, careless, or even drunk drivers at the wheel, are greatly increasing the aggregate number of fractures and extensive injuries.

Formerly railroad surgeons, located along the line, handled a large percentage of these injuries. They had special instructions, and often special training, and not infrequently were supplied with special equipment for handling such cases.

But in this decade, highway injuries occur in every town and hamlet, and even in remote areas. And first aid is often rendered by a doctor who rarely treats a serious fracture. More frequently the patient is put in a "Good Samaritan's" car, and rushed pell-mell to the nearest hospital. Often an ambulance is called.

This paper is a plea for better first aid and greater care in transporting such injuries.

FIRST aid should include a fairly careful and not too hurried examination, to locate all serious injuries. This usually does not require complete removal of all clothing, but each extremity, the thorax, pelvis, spine, and especially the neck and skull, should be examined as carefully as practical under the existing circumstances, before any effort at transportation. Occasionally, the most serious injury is not complained of, and lesser injuries are exposed or bleeding, and it is easy to fail to detect some serious injury.

Who, of extensive hospital experience, has not seen simple fractures converted into compound, or injured arteries further injured, or spine injuries or viscera injury harmed by hasty and improper first handling of such cases.

The majority of these cases should be considered serious until examination proves the contrary.

Long-bone injuries should have proper or at least the best available support applied.

Comparatively few laymen have had good first aid training, so are awkward in assistance in moving the seriously injured. But they are invariably anxious to assist in dragging and pushing these cases in the back of a car and hurrying them to a hospital—ignorant of the harm that may be done thereby.

In fractures of the extremities some supportive material is usually available. This possibly is not ideal, but it may be used as protective measures.

Thin boards, slats from a fruit crate, or even small straight limbs from a tree or shrubbery, especially if split, may be used. Neckties, strips from a shirt, etc., may be utilized in the absence of bandages.

A pillow with a furrow or groove made in the middle and tied above and below is not ideal, but it may be useful. A broom, from axilla to foot, makes a helpful lateral splint for a fractured femur. A pillow or two may be helpful in spine injuries, especially of cervical fractures.

The temperature of the atmosphere should determine the amount of exposure of body surface. If clothing is cut for examination, closure may be made promptly, but pins are not necessary, except occasionally. The bandages, or strings, including the clothing with the splints, will approximate the cut clothing.

For open wounds, sterile or moist antiseptic dressings should be applied, without effort to thoroughly cleanse wound. That is best done in the hospital, or in the patient's bed.

For fractures of the arm or forearm, the Murray-Thomas splint, and for fractures of the thigh and leg, the Thomas splint, are best for transportation. Ofter the extension of the foot can be made best by the clove hitch over the shoe. The splints should be over the clothing if possible, as the clothing serves as padding and protects the surface.

Only a few surgeons or ambulances are provided with these splints, and often the surgeon, even if he has them for emergency use, does not have them with him at the time. Also, only a small number of ambulance drivers have such first aid training as will enable them to apply these efficiently and safely.

The American College of Surgeons, through its Fracture Committee, and its state or regional fracture committees, is trying to improve the existing conditions, and the American Red Cross is establishing first aid stations in charge of one trained in first aid. These stations are being added gradually on the principal highways.

WHEN a doctor renders first aid and is without proper splints, he should, if it is practical, send to his office or to a first aid station for the proper splints, rather than to transport the patient without such much needed dressings. The layman, and often the patient, and sometimes the doctor, is in a great hurry to get the patient on the way to a hospital. Each should follow the trite aphorism: "While doing good, do no harm."

In most sections of the country, ambulance service is furnished by the undertakers. Many of these have training as embalmers and know some anatomy, but they are not well trained in first aid. The Fracture Committees are trying to stimulate a more general first aid training among them, and are urging that each ambulance carry the Murray-Thomas splint for the upper extremity, and the Thomas splint for the lower extremity, or proper sizes and the more often used slat splints. Very little success is reported thus far. It seems to be the prevailing opinion that these objectives can be attained only by state legislative action. But it cannot be attained even so with the general indifference of the public mind at this time. The education of the public and a propaganda by doctors, the Red Cross and other leaders, will be necessary to create a public demand for such legislation. We each should do our part in furthering this cause.

It is needless to say that every hospital, large and small, should have these splints and splint ma-

* Read at the Annual Meeting of the Association of Surgeons of the Southern Railway, Jacksonville, Florida, June 8, 1937.

terial available, and that doctors also should be so equipped.

Formerly most railway fractures were transported to the home terminal, but with the advent of town and community hospitals many fractures are taken there. Often it would be better to transport them further, if properly done, to a better equipped hospital and a more experienced fracture surgeon. This is one of the objectives of the various Fracture Committees.

Acute Mercurial Poisoning

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and
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THE toxic effects of mercury are well known; but, with the hope that a review of our recent experience may be of value, a resume of the investigation to determine the cause and prevent the recurrence of such an injury, and the subjective and objective symptoms of these 32 patients, are recorded in the folowing report.

From July 31 through August 2, 1937, workmen were engaged in cutting out the tops of stills (tanks). These stills, which are equipped with vertical agitator shafts extending through the center of the lid, were closed with mercury seals, which seals were necessary to prevent vapors from being released into the room. A newly designed water seal was developed, and one of this latter type had been installed on one of the stills several weeks ago. As this worked satisfactorily, the present job was to remove the mercury seals from the remaining stills and install the new water seals.

In the course of operations extending over a period of several years, small quantities of mercury had been spilled from time to time from the open seals upon the lids of the stills. Most of this was probably released when it was necessary to clean the old emulsified mercury. As it is almost impossible to pick up small droplets of mercury, some of it always remained on the top of the lids. Each time the stills were painted these fine droplets of mercury were covered, a paint spray-gun being used, and retained in and between the paint layers.

The first part of the job was to cut a circular hole about 15 inches in diameter in the still lid around the outside edge of the mercury seal. Before this was done, all of the visible metallic mercury was removed from the seals and cleaned up. The welders then started cutting the holes with oxyacetylene torches, burning through the coats of paint and the steel, and the usual odor of burnt paint fumes was all that was noticed.

On July 31, 1937, the first day of work at this job, there was not sufficient ventilation. The work was located in a room which was air conditioned and therefore had stationary windows. On this first day of exposure to mercury fumes, there were plenty of electric fans in use and the doors to the room were open, but this did not suffice. On the second day of exposure, August 1, 1937, windows were entirely removed, fans and compressed air were used; nevertheless, workmen who had not been in the room the day before were made toxic from the effect of these fumes. On the third day, August 2, 1937, on which day the job was completed, oxygen tanks and masks were used, and these men, unexposed previously, had no ill effects.

Some of this same work had been done prior to this time in the same room without even fan ventilation, and no ill effects had been complained of or noted. However, on this occasion, only one seal had been removed from the top of one tank, which was new and had not been repainted, and therefore did not have an accumulation of old mercury.

During the course of the three days required to complete this job, 32 men suffered from the effects of mercury poisoning. In most of these patients, the only symptom shown was a gingivitis. It was the men who were exposed on the first day who were the most severely affected, and three of them required hospitalization. These men were the actual handlers of the oxyacetylene torches, welders, and therefore the most exposed to the vapors; and it was the welders on the second day who showed more symptoms than did the helpers and laborers who composed the rest of the working crew on this job.

The first man to be hospitalized was taken sick late in the afternoon of July 31, and at first showed only a gingivitis, salivation, and a headache. Later, acute abdominal cramps developed, with a diarrhea and bloody stools. Later still, he complained of a severe pain in the mediastinum. With this there was a prostration, temperature of 99°, pulse of 100, and respiration of 24. Hospitalization with symptomatic treatment was given. This patient showed on alternate days for three days an albuminuria and a glycosuria, the combination not occurring together, and not very marked. Blood chemistry was normal. This patient lost the most time of any, and following his discharge from the hospital on August 7 complained mostly of being weak and tired. He returned to work on August 16, still somewhat weak, but otherwise feeling well.

The second man hospitalized had a temperature of 103° shortly after he had gone home from his eight-hour shift. The development of his illness was similar to that of the first patient in that he did not feel ill during the day, but noticed that he was 'spitting' more than normally before he went home in the afternoon. The day was quite warm, and there may have been a heat prostration element in this rise in temperature, as he was the only one who showed a temperature this high, and it so happened that he was exposed to a little more heat than the others in that he had a day shift. Urine examination on this man was negative. He had no blood in his stools, but did complain of the mediastinal pain and abdominal cramps. On the road to the hospital this patient described the situation tersely as follows: "This is the first time that I have ever been hurt by something that I could not see, smell, or feel." A number of the other men, when this statement was quoted to them, agreed with it. This man left the hospital on August 3 and returned to work on August 9.

The third man to be hospitalized complained only of the sore mouth, metallic taste, pain in the mediastinum, and abdominal cramps. There were no abnormal fecal or urinary findings. He was hospitalized on August 2, discharged from the hospital August 3, and returned to work August 9.

Three other men lost time from work, but were

not hospitalized. Their complaints were sore mouth, metallic taste, mediastinal pain, and abdominal cramps. Respectively, they lost two, eight, and eight days. As in the instance of the first patient, symptomatic treatment was given to these three and to the other two who were hospitalized.

The rest of the men, helpers and laborers, also received treatment under the supervision of a dentist and a physician, this treatment consisting of an alkaline mouth wash. None of them lost time, but symptoms of a gingivitis persisted for varying lengths of time up to two weeks. As could be expected, the dentist reported that objective symptoms were more severe in those whose gums and teeth were not in a healthy condition.

Another point—frequently noted in people who are ill, in that there are periods when they feel better and then not so well—was very sharply defined by many of these men, especially among the more toxic, and special notation was made regarding it in caring for the hospitalized patients. Within 15 minutes there would be an abrupt and marked change in the patient's condition, and there were numerous recurrences of these changes. A patient would be seen sitting up in bed, with no objective or subjective symptoms, and stating that he was feeling fine. In a very few minutes there might be prostration, cold sweat, difficult breathing, mediastinal pain, and abdominal cramps. These symptoms would disappear as quickly as they arose, only to recur in from one-half hour to several hours. There was no regularity about the time element in the buoyant or low periods.

A Medical Control Plan

—For the Prevention of Occupational Disease—

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Chicago

THE VALUE of routine medical examination is in itself of inestimable significance whether it be from a personal, employer, or an insurance carrier standpoint.*

Any form of medical control program has the idea of prevention for its foundation. No employee, suffering from any particular ailment of which he is conscious and the nature of which he is entirely familiar with, is desirous of working under conditions whereby this condition will be further impaired. Likewise, the employer is not desirous of exposing an employee to an occupation which he is not medically capable of performing. Besides having the employee's welfare in mind, the employer also considers the probable inefficiency of anyone who is not medically robust. The insurance carrier, naturally interested in the loss experience of any particular risk, considers with favor any prospective business when a Medical Control Program from a preventive standpoint is carried out by the prospective assured.

Since the passing of occupational disease laws, or the revision of pre-existing occupational disease laws, in various States of the Union, many employees, business executives, and insurance companies have been confronted with the numerous aspects of this subject.

The employee, unacquainted as he frequently is with the true nature of his industrial environment, becomes unduly alarmed when suffering from a bronchial cold, or vague gastro-intestinal symptoms. He imagines himself suffering from silicosis or lead colic if he is in any way subjected to dust or a minimum amount of lead. The employer, with production as his primary interest, particularly so during this post-depression era, often fails to realize the need for proper engineering control over health and accident hazards. He considers the expense involved unnecessary and the recommendations unwarranted. When the subject of occupational disease is brought to his attention, he considers it some "new racket" concocted by the medical profession, and just another means whereby his overhead will be increased.

The insurance company is able, from its experience in such matters, to advise the employer. As many of the large corporations are self insurers, and have their own well established medical control systems, the subject of occupational disease is well understood by them. It is the small corporations, with from 25 to 300 employees, where the subject in question is not so well understood. In such instances the insurance company so interested can function.

Since the passage of the revised version of the Illinois Occupational Disease Law in October, 1936, it has been my privilege to discuss this subject with numerous employees, small firm executives, and examining physicians. In almost every instance the lack of a true understanding of the purpose of the law and the various medical examinations that are necessary to ascertain the real degree of any hazard is indubitable.

In order to fulfill the ultimate intent, namely, efficiency, comprehension, and harmony, of any medical control program which has as its purpose prevention, there must be an exact understanding existing among the various parties involved, with respect to the part each plays in the program. The parties involved are necessarily:

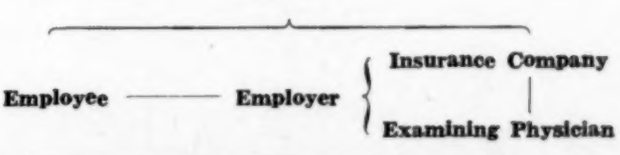
The employee, whose health from an occupational disease standpoint must be safeguarded, regardless of cost;

The examining physician, whose duty it is to have a knowledge of the occupational hazard in question, thereby enabling him to advise following a detailed medical examination as to the medical status of an individual in relation to a proposed hazardous environment;

The employer, who not only has his employee's medical welfare to consider, but also desires efficiency from those whom he employs; and

The insurance company which indemnifies the employer for the liability imposed upon him by the law.

The existing relationship of these various factors may be summarized as follows:



* Read before the August meeting of the Greater Chicago Safety Council, August 19, 1937, Palmer House, Chicago.

To incorporate these ideas, and, to some extent, ideals, into a comprehensive form, the following Medical Control program is recommended. Occupational disease hazards—including dust, primarily inorganic, which tends to predispose to silicosis and asbestosis—lead, and toxic irritants, including liquids, solids, vapors, gases and fumes are considered.

In each instance an individual medical examination form has been prepared, as shown in their successive appearances here.

Purpose:

THE purpose of a Medical Control program is to safeguard the health of employees engaged in operations where an occupational disease exposure exists.

It is an employee welfare program based upon the proposition that individuals having certain health impairments should be placed at work which will not aggravate their condition.

ployee at the time of termination of employment, thereby assuring him that he has not suffered ill effects as a result of his occupation.

Administration Responsibilities:

IN THE administration of this medical control program there must be a complete understanding of the responsibilities of the three interests: employer, examining physician, and insurance company.

THE EMPLOYER: (a) An understanding as to the expense of physical examinations as specified must be understood by theemployer. (b) New employees are to be sent to theexamining physician before they start to work in any departments or operations listed in the accompanying schedule. (Fig. 1) and are not to be placed at work unless the report rendered by the examining physician indicates that they are medically suitable for exposure to the hazards involved. (c) Employees are to be sent to the examining physician for re-examina-

FIG. 1

SCHEDULE OF DEPARTMENTS, OPERATIONS, EXPOSURES AND PHYSICAL EXAMINATIONS

(applies to all employees working full or part time in departments listed)

Department	Operation	Occupational Disease Exposure	Pre-Employment Physical Examination	Frequency of Periodical Physical Examination	Exit Physical Examinations
Battery	Burning	Lead	Yes FORM M-B	Monthly FORM M-C	All cases
Grinding, polishing and buffing.	Wet grinding, portable grinding, polishing and buffing.	Dust	Yes FORM M-D	Only as specified by examining physician at time of initial examination FORM M-E	Only in individual cases
Foundry	Moulding	Dust	Yes FORM M-D	Yes Biennially FORM M-E	Only in individual cases
Electro-plating	All operations other than chrome plating	Fumes and Vapors Toxic Irritants	Yes FORM M-F	Only as specified by examining physician at time of initial examination FORM M-G	None
Electro-plating	Chrome plating	Chromic acid Acid fumes	Yes FORM M-F	Annually FORM M-G	Only in individual cases
All departments	All operations			Monthly summaries to be made FORM M-A	

Such a program embraces the following examinations:

(a) PRE-EMPLOYMENT: The purpose of pre-employment examinations is to place new employees in work for which they are medically qualified. Facts ascertained at this time acquaint the employee as to his medical needs, and, upon request, he may obtain advice as to the treatment necessary in his particular case.

(b) PERIODICAL: The purpose of periodical examinations is to check the health of employees engaged in operations where a health hazard exists so that action may be taken by the employer either to transfer those showing symptoms of diseases or reduce the hazards by engineering methods.

(c) EXIT: The purpose of exit examinatoins is to have a record of the physical welfare of the employee at the time of termination of employment, thereby assuring him that he has not suffered ill effects as a result of his occupation.

tion in accordance with the frequency established in the accompanying schedule, and action is to be taken by the employer promptly to transfer to non-hazardous work those whom the examining physician reports as not suitable for continuation in a given exposure. Re-examination of employees for reasons other than those stated above is indicated only if an employee has been absent from work for a period of three months from any cause, or during the period of his absence he has been exposed to any of the following hazards: Lead, degreasing (chlorinated hydrocarbons), arc-welding, or spray painting.

If the employee has been so exposed a re-examination should be made, and a signed occupational record of his activities during his absence should be kept on file for further reference.

THE EXAMINING PHYSICIAN: The examining physician shall satisfy all interested parties as to the character and thoroughness of his work. He shall have an agreement with the employer on the price of the work which he will perform. He shall requisition, and use, the physical examination and monthly summary report forms as furnished (Figs. 2 to 8). He shall make the examinations in accordance with the specifications given in this program as a minimum. Where chest x-rays or clinical laboratory tests are specified he shall arrange to have such work performed, and interpreted so that he will render the reports of interpretation, etc., to all interested parties as quickly as possible. He shall occasionally inspect the the operations to become personally familiar with the occupational exposures. Finally, he shall render in his reports definite opinions as to the suitability of employees from a health standpoint for continuance in occupational exposures.

THE INSURANCE COMPANY: It is the intent of an insurance company through its medical department to adequately ascertain the medical status of all employees subjected in any way to a possible occupational disease exposure. It is not the intent of an insurance company to encourage, per-

FORM M-B. FIG. 2.

PRE-EMPLOYMENT PHYSICAL EXAMINATION REPORT FOR EMPLOYEES SUBJECT TO LEAD EXPOSURE

Employer..... Address.....
Employee..... Address.....
Proposed occupation..... Department..... Date.....

PREVIOUS OCCUPATIONAL HISTORY:

(a) Hazardous — Name of employer and duration of exposure indicated (1)..... (2)..... (3)..... (4).....
(b) Non-hazardous significant occupations only (toolmaker, carpenter, etc.) (1)..... (2)..... (3)..... (4).....

PREVIOUS MEDICAL HISTORY:

(a) Previous major illness, accidents and operations.....
(b) Every suffered from PLUMBISM.....DATES.....
(c) At present suffering from any chronic ailment?.....
(Upper respiratory, Gastro-intestinal, Cardiovascular or Genito-urinay)

FAMILY HISTORY.....
SIGNED.....
Employee

PHYSICAL EXAMINATION

General appearance..... Nationality.....
Sex.....Age.....Height..... Weight.....
Deformities .....
Eyes: ....
EOM. Pupils Reaction Sclera Conjunctiva
Vision: Without glasses With glasses R20/ L20/
Ears.....Hearing: R.....L.....Nose.....Septum.....
Mouth: Tongue.....Teeth.....Gums.....Lead Line.....
Chest: Measurements at rest.....
Following full inspiration.....Expansion.....
(a) Lungs: Palpation.....Auscultation.....Percussion.....
(b) Heart:.....Blood pressure.....
Pulse..... Temperature..... Respirations.....
Abdomen..... Back.....
Hernia:..... Rings..... Genitalia.....
Extremities .....

LABORATORY STUDIES: Hemoglobin.....
Basophilic aggregations (McCord Tech.).....
(Strippled Cells per million red blood cells)
Serology (Wass. or Kahn).....Urinalysis.....
Other studies to be made when indicated.....
(Complete blood count, stool examination, reticulocyte count, etc.)

Impressions: Lead absorption.....Lead intoxication.....
Physical status: Excellent.....Average.....
Questionable..... Poor.....
Recommendations: (Diet, treatment, protection, etc.).....
.....
Conclusions: Suitable for lead exposure (yes or no).....
Date..... Examined by.....M. D.
Signature

FORM M-C. FIG. 3.

PERIODICAL EXAMINATION FOR EMPLOYEES SUBJECT TO LEAD EXPOSURE

Employer..... Address.....
Employee..... Address.....
Department..... Occupation.....
Date of previous examination.....
State of general health since previous examination.....
Injuries sustained since previous examination.....
Under physician's care: personal or as a result of occupation for.....days since prevous examination.
Number of working days missed (a) personal.....
(b) as a result of occupation.....(c) lack of work.....
Present complaints:.....
(a) Cardio-respiratory .....
(b) Genito-urinary .....
(c) Gastro-intestinal (cramps, diarrhea, constipation, etc.) .....
.....
Blood studies at previous examination: Hemoglobin.....
Basophilic aggregation (McCord Tech.).....
(Cells per million R.B.C.)
Impressions at last examination: Lead absorption.....
Lead intoxication.....
Physical status at last examination: Excellent.....
Average..... Questionable..... Poor.....
RECOMMENDATIONS for treatment at last examination.....
.....

PHYSICAL EXAMINATION

General appearance.....Head.....Eyes.....
Nose.....Septum.....Ears..... Mouth.....
Teeth.....Gums.....Lead line.....Extremities .....
Tremors .....
Laboratory work: Hemoglobin.....
Basophilic aggregation (McCord Tech.).....
(Cells per million R.B.C.)
Other laboratory studies when indicated:.....
(Serology, urinalysis, complete blood count, etc.)
.....
IMPRESSIONS: Lead absorption.....
Lead intoxication.....
PHYSICAL STATUS: Excellent.....Average.....
Questionable..... Poor .....
RECOMMENDATIONS: (Diet, treatment, protection, etc.).....
.....
CONCLUSIONS: Suitable for continuance in present occupation .....
Date of present examination.....
Examination by.....M. D.
Signature

FORM M-D. FIG. 4.
PRE-EMPLOYMENT PHYSICAL EXAMINATION REPORT FOR EMPLOYEES SUBJECT TO DUST EXPOSURE

Employer..... Address.....
Employee.....Address.....Social Security No.....
Date of employment.....Department.....
Present occupation.....

PREVIOUS OCCUPATIONAL AND MEDICAL HISTORY

State name of employer and indicate length of exposure in the following occupations:

Brick or glass mfg.....Foundry (type).....
Sandblasting..... Stone cutting.....
Quarrying..... Pottery making.....
Mining..... Asbestos Work.....
Polishing, Buffing, Grinding.....
.....
Previous medical history.....
(Significant illnesses only)
Significant family history.....
Date..... Signed.....
Employee

Present complaints:
Cardio-respiratory .....
Gastro-intestinal .....
Genito-urinary .....

PHYSICAL EXAMINATION

General appearance.....
Nationality..... Sex..... Age.....
Height.....Weight.....Weight one year ago was.....
Deformities .....
Eyes: EOM.....Pupils.....
Reaction..... Sclera.....Conjunctiva.....
Vision with, without, glasses R..... L.....
Ears: Hearing: R..... L.....
Nose..... Tongue..... Teeth..... Gums.....
Chest: Measurements at rest.....After full inspiration.....
After exercise..... Respirations.....
(a) Lungs: Palpation.....Percussion.....Auscultation.....
(b) Heart:.....Blood pressure.....
Pulse..... Temperature.....
Abdomen..... Back.....
Hernia..... Rings..... Genitalia.....
Extremities .....
Laboratory work: Hemoglobin.....
Serology (Wass., Kahn).....
Urinalysis .....
Other studies made.....

ROENTGENOLOGICAL STUDY OF CHEST

(Accepted technique 100 M. A.; focal distance 72 inches; time 1/10 sec.)

Date photographed.....Identification marks.....
Sterio or flat.....Films (Make).....Screens.....
Exposure factor M. A.....K. V.....Distance.....Time.....
Patient's position.....Are films clear?.....
Findings:
Conclusions .....
.....M. D.
Roentgenologist
.....
Address

Physical status: Excellent.....Average.....
Questionable..... Poor .....
Remarks: .....
Recommendations .....
.....
Suitable for dust exposure (Yes or No).....
Date..... Examined by.....M. D.
Signature

suade or attempt to influence the employer or examining physician arbitrarily or unreasonably to refuse employment to or to discharge employees. The medical department is responsible for the development of medical control which will reasonably protect the health, and safety of the employee from the contraction of occupational disease. In this connection the medical department has the authority to modify or increase the requirements of this program. The medical department shall receive examination reports, and monthly summaries from the examining physician, and satisfy itself that proper action is being taken by the employer regarding the medical welfare of the employee. Correspondence shall be conducted with the employer or the examining physician where indicated.

FORM M-E. FIG. 5.
PERIODICAL EXAMINATION FOR EMPLOYEES SUBJECT TO DUST EXPOSURE

Employer..... Address.....
Employee..... Address.....
Department..... Occupation.....
Date of previous examination.....
State of general health since previous examination.....
Injuries sustained since previous examination.....
Under physician's care: personal or as a result of occupation for.....days since previous examination.
Number of working days missed (a)personal.....
(b) as a result of occupation.....(c) lack of work.....
Present complaints: .....
(a) Cardio-respiratory .....
(b) Genito-urinary .....
(c) Gastro-intestinal .....
.....
Significant clinical findings recorded at previous examination (X-ray findings, etc.).....
.....
Physical status at last examination: Excellent.....
Average..... Questionable..... Poor.....
Recommendations for treatment at last examination.....
.....

PHYSICAL EXAMINATION

(Special reference given to cardio-respiratory system)

Loss, gain of.....lbs. since last examination.
General appearance.....Eyes.....Weight.....
Mouth..... Teeth..... Blood pressure.....
Chest expansion.....was.....at last examination.
X-ray of chest: Exposure factors M.A.....K.V.....
D.....T.....sec. I.M.....
.....
(Signed).....M. D.
Roentgenologist
Additional significant findings including laboratory work
.....
.....
Present physical status: Excellent.....
Average..... Questionable..... Poor.....
Recommendations for treatment.....
.....
Conclusions: Suitable for continuance in present occupation (Yes or No).....
Date..... Examined by:.....M. D.
Signature

THE ENGINEERING DEPARTMENT of an insurance company is responsible for recommending to the employer methods of engineering control to reduce

the occupational disease hazards in the operations. The engineer is not responsible for the determination of the type and frequency of medical examinations but will periodically check with the employer, for the medical department to determine if

FORM M-F. FIG. 6.

PERIODICAL EXAMINATION FORM FOR EMPLOYEES SUBJECT TO THE FOLLOWING EXPOSURES: TOXIC IRRITANTS, INCLUDING SOLIDS, LIQUIDS, GASES, VAPORS AND FUMES

Employer..... Address.....
Employee..... Address.....
Department..... Occupation.....
Date of previous examination.....
State of general health since previous examination.....
Injuries sustained since previous examination.....
Under physician's care: personal or as a result of occupation for.....days since previous examination.
Number of working days missed (a) personal.....
(b) as a result of occupation.....(c) lack of work.....
Present complaints: (Special reference to skin and upper respiratory system)
(a) Cardio-respiratory .....
(b) Genito-urinary .....
(c) Gastro-intestinal .....
(d) Skin .....
Significant clinical findings recorded at previous examination—Blood count, etc.....
Physical status at previous examination: Excelelnt.....
Average..... Questionable..... Poor.....
Recommendation of treatment at last examination.....
.....

PHYSICAL EXAMINATION

(Special reference given to skin and upper respiratory system)

General appearance.....Weight.....at last exam. was.....lbs.: Eyes.....Sclera.....Icterus.....
Nose..... Septum..... Mouth..... Teeth.....
Gums.....Chest.....Heart.....Blood pressure.....
Pulse.....Abdomen.....Extremities (Dermatitis) .....
Laboratory work: Urinalysis.....Hemoglobin.....
RBC..... WBC .....
Differential .....
.....
Present physical status: Excellent.....
Average..... Questionable..... Poor.....
Present recommendations for treatment.....
Conclusions: Employee.....
is, is not
suitable for continued exposure to.....
State Exposure
Date..... Examining Physician.....M. D.
Signature

FORM M-G. FIG. 7.

PRE-EMPLOYMENT PHYSICAL EXAMINATION REPORT FOR EMPLOYEES SUBJECT TO THE FOLLOWING EXPOSURES: TOXIC IRRITANTS, INCLUDING SOLIDS, LIQUIDS, GASES, VAPORS AND FUMES

Employer..... Address.....
Employee..... Address.....
Date of employment.....Department.....
Occupation.....Date of examination.....
Previous occupation
(a) Hazardous, with specific reference to the above exposures. Name of employer and duration of exposure to be stated. (1)..... (2)..... (3)..... (4).....
(b) Non-hazardous. Significant occupations only. (1)..... (2)..... (3).....
Previous medical history.....
Significant family history.....
Date..... Signed.....
Employee

PHYSICAL EXAMINATION

(Special reference to skin, upper respiratory and cardiovasual systems)

Present complaints: .....
.....
General appearance.....Nationality.....Sex.....
Age.....Height.....Wt., now.....1 Yr. Ago.....
Skin..... Eyes: EOM.....Sclera.....
(dermatitis)
Conjunctiva..... Pupils .....
Vision: R. 20/ L.20/ Color Blindness.....
Nose..... Septum.....
Mouth: Tongue.....Teeth.....Gums.....Neck.....
Chest: Expansion.....Lungs: Palpation.....
Auscultation.....Percussion.....Heart.....
Blood pressure.....T.....P.....
Abdomen..... Back..... Genitalia.....
Extremities..... Deformities.....
Blood studies: Hemoglobin.....R. B. Count.....
W. B. Count.....Differential.....
Urinalysis .....
Other laboratory studies including x-ray, where indicated. (i.e. Serology, McCord count, Reticulocyte count, etc.) .....
Physical status:
Excellent.....Average.....Questionable.....Poor.....
Recommendations .....
.....
Employee.....Suitable for exposure to.....
is, is not *State exposure*
Date..... Examining Physician.....
Signature

FORM M A. FIG. 8

SUMMARY OF PRE-EMPLOYMENT AND PERIODICAL MEDICAL EXAMINATIONS FOR THE MONTH OF.....

Employer.....

Address.....

IF PERIODICAL

Employee	Date and type of Examination Kind of Exposure	Date of previous examination together with significant clinical and laboratory findings.	Previous physical status and recommendations for treatment.	Present physical status together with significant clinical and laboratory findings.	Present recommendations for treatment.	Suitable for exposure (Yes or No)

employees are being sent to the examining physician as specified in this program. (Fig. 1.)

MONTHLY SUMMARIES: The examining physician shall make a monthly summary of all examinations. Reports to be made on form M-A (Fig. 8).

PROCEDURE IN HANDLING REPORTS: Each examination report shall bear the signature of the medical doctor who *actually* made the examination. Copies of examination reports shall be distributed as soon as completed. Monthly summaries to be distributed promptly after end of each month.

To be sure that all parties concerned have an exact and like knowledge of the contents and conditions of such a program, each should apply his signature of approval in the space allotted on the front sheet of the program (Fig. 9) and a copy of the entire program should be kept on file.

MEDICAL CONTROL PLAN

A. B. C. Company
1842 South 54th. Avenue
Chicago, Illinois

Approved .....
Employer

Approved .....
Insurance Company

Date..... Approved .....
Examining Physician

FIG. 9.

Conclusion:

WITH every degree of efficiency with which such a Medical Control program is carried out the probability of occupational disease resulting from exposure will, I feel certain, be lessened in direct proportion; its actual occurrence being at a minimum.

Skeletal Traction

C. P. Fox, M.D.,
Greenville, Tennessee

IN THE treatment of fractures we should strive to secure anatomical reposition of the fragments and functional efficiency of the affected part.* Everyone knows that there is, at present, a failure to obtain these results in a great many cases. Of course there are times when the nature of the fracture and the injury to the soft parts make this very difficult or impossible of attainment. However, the fault most often lies in the treatment. When the shafts and other parts of long bones are fractured there is usually a tendency to overlapping and shortening, and often to angulation due to the pull of the muscles attached on either side of the break.

It has been recognized that there must, in a great many cases, be some form of traction utilized to overcome this shortening, etc. Most often the method known as skin traction has been relied on to procure the desired result. However, everyone who has used skin traction must realize its inadequacy and faults. Very often the fracture cannot be reduced, even moderately well, by this means and the adhesive many times slips and too often causes irritation of the skin, with much discomfort to the patient. In addition most patients complain of the pull of the weights, and many patients resort to tricks by means of which they are relieved of this discomfort. Furthermore, if, as frequently happens, there are wounds or burns of the soft tissues, skin traction at times is impossible to apply.

Skeletal traction or bone traction overcomes most of these disadvantages. With it the pull of the weights or screw is applied directly to the bone and it is very much more efficient for this reason. The same result is obtained with less than half the weight required by skin traction, and one can always be sure that, unless a fracture is too old, the shortening can be overcome and the fracture reduced and kept in the proper position until union, sufficient to hold the fracture, has had time to occur.

Skeletal traction also provides the most comfortable means of treating fractures so far as the patient is concerned. There is absolutely no discomfort from the pull of the weight or the screw and patients would not know that a wire or pin had been placed through the bone if they were not told that this had been done.

This form of treatment in addition allows greater mobility of the joints of the affected limb, and so shortens the time of disability. It can be so arranged as to allow patients to assume a greater variety of positions in bed or to be up and about in a wheel chair. This adds greatly to the comfort of the patient and also lessens very much the danger of pneumonia and other complications in the aged.

THERE are several different methods of applying skeletal traction. The oldest and probably the most frequently used method, up to recent times, is the application of ice tongs or calipers. This has been used chiefly in the femur, and has several disadvantages. One can never be sure that the tongs will not slip and cause much damage to the bone and soft parts, as well as losing the desired effect on the bone. Also they are likely to limit mobility of the joints and of the patient much more than other methods.

Another form of bone traction is secured by driving nails or screws into the sides of the bone. These are not driven through the thickness of the bone and so are also as likely to slip as are the tongs.

The most satisfactory way of securing skeletal traction is to drill a wire or pin through the entire thickness of the bone. With this method there is no likelihood of slipping and a strong continuous traction can be maintained.

The best wire for this purpose is probably the Kirschner wire which is chrome-plated or rustless steel. It is sharp on one end and flat on the other. It is passed through the bone by means of a special drill into which it is made to fit.

The best pin is the Steinman pin which is much larger than the wire. It is also sharp on one end and flat on the other. The flattened end fits into a special handle by means of which it is driven

* Read at the Annual Meeting of the Association of Surgeons of the Southern Railway, Jacksonville, Florida, June 8, 1937.

through the bone. A recent modification of the pin is so constructed that it can be unscrewed in the center of its length and each end withdrawn without an exposed part having to be pulled through the bone. This lessens greatly any chance of infection of the bone.

Special tractors or spreaders are made for the wires and pins and it is by means of them that the traction is exerted on the fractured bone. Even though the wire is small in diameter, 5 mm. to 2 mm., it can withstand all the pull that is necessary without danger of breaking.

We usually use the wire through the femur, humerus, and radius and ulna and use the pin to pass through the tibia and os calcis. In fractures of the shaft and neck of the femur we prefer to pass a Kirschner wire through a point just above the condyles of the femur. In this, as in all cases where we pass a wire or pin through the bone, we prepare the skin, over the site selected for drilling, 24 hours before the metal is actually passed. The skin is shaved, sponged with alcohol and ether, and then painted with Scott's solution. The following day we prepare as for an abdominal operation. In this may we feel that there is little danger of carrying infection into the bone.

After the wire has been passed we place sterile gauze over each end and attach the spreader and tighten it so that the wire will not bend. The patient is then returned to bed and the affected limb is placed on a Boehler frame and weights are attached to a rope which is tied to a hook on the spreader and passes over the pulleys of the frame. In adults it is usually necessary to apply 25 lbs. to 35 lbs. of weight for a few days after which it is decreased to 15 lbs. The fracture is x-rayed frequently so that it is known when complete reduction has occurred and distraction or over-reduction is avoided.

During treatment the patient can be propped up in bed or he can lie flat. The traction should if possible be continued for around eight weeks, but after four weeks there is usually sufficient union to hold the fragments pretty well and a plaster of Paris spica, which incorporates the wire, may be put on and the patient allowed to go home. Most patients complain considerably of the cast and wish that they had continued with the original form of treatment, but satisfactory results are obtained with the cast although temporarily stiff joints have to be contended with after the cast has been removed.

So far as results are concerned there is another method by which skeletal traction can be satisfactorily applied to the femur, and in the aged it is to be preferred because it allows the patient to be up in a wheel chair. This method is one in which the Rogers or Wiltrout well-leg splint is used. It is employed in fractures of the shaft or neck of the femur. A Steinman pin is passed through the tibia at a point just above the malleoli. Sterile gauze is placed over the ends of the pin and this held in place by a bandage. A plaster of Paris cast is applied to the well leg so as to include all of the limb from the toes to the mid-thigh. Perforations of the stirrup of the splint are passed over the ends of the pin, and cork and felt used to cover the protruding ends of the pin. A plaster of Paris cast is then applied from the toes to a point just below the knee of the leg of the fractured limb, and the stirrup of the splint and ends of the pin are incorporated in the cast. At the same time an assistant incorporates the metal attachment for the well leg in the cast on that side. After the plaster has set, traction is applied to the fractured femur by means of a screw attachment which produces a pulling force on the fractured leg and a pushing force on the well leg. After a day or two the patient may be gotten up in a wheel chair.

This form of treatment is practically as efficient as the one first mentioned so far as results are concerned, but it is not nearly so comfortable. The patients at first complain very much of pain in the hip of the sound side because of the pressure exerted there. It is often necessary to give opiates for this pain in the beginning, but after a few days they are relieved with mild analgesics and finally require no medication for pain. We have obtained some very excellent results with this method.

WE HAVE used skeletal traction also in fractures of the humerus and of both bones of the leg with equally good results. It is not necessary to describe the apparatus and methods used in these fractures, for the principles are the same as for fractures of the femur. However, it would be well to discuss the care of the wounds made when the wire or pin is inserted and also the removal of the wire or pin.

We make small skin incisions on each side of the limb where the wire or pin is to be placed. This is done to prevent pressure and necrosis of the skin where the metal would be in contact with it if incisions were not made. The wounds are antisepticized and dressed with sterile gauze after the operation is completed, but no further dressing is done until the time of removal.

When the wire is to be removed it is cut off short on the end which is to be drawn through the bone and this end is wiped off with alcohol and then thoroughly painted with tincture of iodine. The other end is grasped with sterile forceps and the wire is easily withdrawn.

The pin is removed in a similar manner except that it cannot be cut off. If the newer type pin has been used, it is unscrewed in the center and withdrawn from each side without any exposed part touching the bone or soft tissues.

Before closing I would like to discuss briefly a few cases.

CASE No. 1 was a high school football player 17 years of age. While scrimmaging with a college team he was knocked down. As he fell he heard a "popping" niose and when he tried to rise found he could not use his left leg. He was brought to the hospital and x-rays showed a comminuted fracture through the middle third of the shaft of the femur with considerable overlapping, angulation and comminution.

The thigh was prepared with alcohol and ether, and Scott's solution and a sterile dressing applied. The limb was placed in a temporary splint for 24 hours. With the usual aseptic precautions under spinal anesthesia a Kirschner wire was passed through the femur at a point just above the condyles. The wounds were aseptically dressed around the ends of the wire and a tractor was at-

tached to the wire. The patient was returned to his bed and the limb placed on a Boehler splint and 25 lbs. of weight attached. X-ray the following day showed only partial reduction. The weight was then increased to 30 lbs. Another x-ray in 24 hours after the weight was increased showed reduction more nearly but not quite complete. An additional five pounds, making 35 lbs. in all, were applied. In 48 hours a skiagram showed over-reduction or distraction. The weights were gradually decreased and frequent x-rays made. The distraction was not overcome until a reduction to 15 lbs. had been made. Then there was a slight overlapping and 2½ lbs, had to be added to secure end-to-end contact.

The skeletal traction was maintained for six weeks, after which, for financial reasons, the patient felt that he could not remain longer in the hospital. Position was then good and union had progressed sufficiently so that it was felt that the fracture could be held by a plaster of Paris spica. This was applied and the patient allowed to go home. At the time the cast was applied all of the joints were mobile but when he returned four weeks after this change had been made, the knee, ankle and hip joint were stiff. However, at this time when the cast was removed there was good union and excellent position.

CASE No. 2, a 72 year old white man, was another fracture of the shaft of the femur. The fracture was in the upper third and was oblique. There was considerable overlapping of the fragments. Because of the age it was decided to use the Rogers well-leg splint so that he could be gotten out of bed. A Steinman pin was inserted through the tibia above the malleoli after the usual antiseptic and aseptic precautions. Low spinal anesthesia was used.

The Rogers well-leg splint was put on and traction applied. In 24 hours an x-ray showed practically perfect reduction and position. After a week the amount of traction was reduced considerably, but x-ray still showed the same position as that shown at first. The patient was allowed up in a wheel chair in a week and went home in 19 days. He returned for examination eight weeks after the fracture occurred. X-ray then showed excellent position and union and the casts and splint were removed. The tissues around the pin appeared perfectly healthy. Coaptation splints were applied to the limb for two weeks more and then all retentive apparatus was removed. The patient went around on crutches for a while, but in less than a year he was going everywhere without any limp whatsoever.

CASE No. 3 was a very fat woman, 65 years of age. She had an intertrochanteric fracture of the right femur with moderate shortening and much malposition. After the usual preparation a Steinman pin was inserted through the lower end of the tibia and a Rogers well-leg splint applied. Twenty-four hours after the traction was instituted a skiagram showed good position and reduction. Because of her extreme weight this patient was not gotten out of bed and she developed hypostatic pneumonia in about three weeks. She, however, soon recovered. When the pin and splint were removed in eight weeks there was good union and position.

CASE No. 4 was a printer 50 years of age who had a rather unusual fracture. There was a fracture of the anatomical neck of the humerus with marked displacement and some comminution. For over two weeks this patient was treated with skin traction and 15 pounds of weight. Very little effect was produced on the fracture by this method, and the patient complained bitterly of the treatment and required many hypodermics of morphine. The adhesive slipped several times and had to be replaced and the skin became very red and rather raw. It was finally decided to institute skeletal traction. Therefore, after 24 hours of preliminary preparation a Kirschner wire was drilled through the humerus at a point just above the condyles. This was done under local anesthesia. The wounds were dressed aseptically and the patient placed upon a fracture bed. A tractor was attached to the ends of the wire and a rope was fixed to the hook of the tractor and passed over a pulley attached to the side of the bed and 15 lbs. weight was applied to the distal end of the rope. The forearm was suspended from an overhead rod and the arm placed in marked abduction.

The 15 lbs. of weight were continued for six days. At this time x-ray showed good reduction and position and the weight was reduced to 10 lbs. A subsequent skiagram revealed the position as being retained by this decreased weight.

The patient was very comfortable with this treatment, but he was anxious to leave the hospital because of expense. For this reason a plaster of Paris shoulder spica was applied while the traction was continued through the wire. The wire was incorporated in the plaster and the arm was placed in abduction. This was done two weeks after the skeletal traction had been instituted. Four weeks after the plaster cast was applied it was removed, as was the wire. The wounds around the wire showed no infection and soon healed. A skiagram made at this time showed good position and union. However, there was stiffness of the shoulder, elbow, and wrist joints. This would not have been true if the patient had been content to be treated with the skeletal traction for the whole period. However, after several months he has largely recovered the use of his arm.

New Books

Reviews by

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Year Book of General Therapeutics

EDITED by DR. BERNARD FANTUS, Professor of Materia Medica, Pharmacology and Therapeutics, University of Illinois College of Medicine, and DR. SAMUEL J. NICHAMIN, Associate Attending Physician, Cook County Hospital, the 1936 Year Book of General Therapeutics presents an unusually wide scope of information of practical therapeutic importance.

Included in the subject matter are General Therapeutic Technic, Antipathogen Therapy, Restoratives, Tissue Alterants, Function Modifiers, Toxicology, and non-pharmacal Therapeutics.

The innumerable advances in the field of therapeutics treated of in this work are so extensive that they cannot be more than mentioned in this review.

Besides the important changes in therapeutic approach in the field of general medicine, of particular interest to the industrial physician and surgeon will be the various subjects treated under the heading of Toxicology, among which are found detection of harmful dusts through animal reactions —prevention of industrial plumbism—urinary lead concentration in diagnosis of lead poisoning—urinary elimination of porphyrin in lead poisoning—urine sulfate test for control of benzol exposure—carbon tetrachlorde poisoning prophylaxis — chronic carbon monoxide anoxemia—acquired tolerance in carbon monoxide poisoning — fluoride poisoning—mottled teeth in diagnosis of fluorosis —elimination and distribution of mercury in mercury bichloride poisoning—roentgen therapy of kidneys in acute mercury poisoning — trichloroethylene intoxication—rhus tovicodendron extract in the prevention of ivy poisoning, and various papers on various phases of aminopyrine, morphine addiction, the tobacco habit, and cinchophen and salicylate poisoning.

The volume has the distinct appeal of covering an unusually wide field in abstracting the distinct advances made in therapeutics during the year 1936. As a reference volume it is therefore of considerable value to every practitioner.

The book contains 460 pages, a subject and author index, and a few well selected illustrations and graphs, as well as diagrams and footnote references to each article abstracted.

The work is published in 1937 by The Year Book Publishers, Inc., 304 S. Dearborn St., Chicago, and is priced at $2.50 postpaid.

Administration of Workmen's Compensation

THIS volume, written by WALTER F. DODD, member of the Chicago Bar and formerly Professor of Law at the Yale University Law School, analyzes the various types of statutory provisions in workmen's compensation laws, points out the administrative problems presented by such provisions, and discusses comparatively the methods employed in dealing with these problems.

Investigation upon which the book was based was started some six years ago, and the study deals with all phases of the administration of workmen's compensation, legal, medical and insurance. The findings have been supplemented and interpreted by an extensive use of the great mass of literature dealing with this subject which has appeared in the last quarter century and during which workmen's compensation has become an essential part of our economic and legal organization. Important changes in the laws in various states, new developments in administrative practice, and notable court decisions have been included up to January, 1936.

The material is developed under the following headings: The Movement Toward Workmen's Compensation—The Enactment of Compensation Laws — Problems of Administering Workmen's Compensation — Court Administration of Workmen's Compensation—Machinery for Administration of Workmen's Compensation—The Uncontested Case—Compromises and Reopened Cases—The Contested Case—Court Review of Compensation Awards—The Medical Problem—Security for Payment of Compensation—The Measure of Compensation—Relationship of Workmen's Compensation to Accident Prevention—Rehabilitation and Lump Sum Settlements—Workmen's Compensation and Employers' Liability—Major Issues of Compensation Administration, and The Progress of Workmen's Compensation.

In reference to his conclusions upon The Medical Problem, the author states: "If any doubts remain as to the importance of the medical end of workmen's compensation, they should be dispelled by the statements heretofore made, for even if the matter is viewed from the standpoint of cost alone, and the humanitarian issues are ignored, so large a portion of the compensation dollar is devoted to medical purposes that the prominence of the medical side of compensation cannot be questioned."

Further along, also speaking about the medical problem, the author says that "Although it has distinct advantages from a theoretical standpoint, the impartial panel of physicians has yet to stand the test of practical operation . . . While awaiting the result of the New York experiment, the other states will maintain their present systems of choice of physicians. But the states which allow selection by the employer may avoid certain of the defects of this system by giving some degree of choice to the employee upon application to the industrial commission, and by requiring medical reports about the employee to be transmitted both to the employer (or insurance carrier) and to the employee at the time when medical service is rendered or medical examinations are made . . ."

Relative to the progress of workmen's compensation: "Much remains to be done toward bettering the content and administration of the compensation laws. This need should not be lost sight of because of present movements for unemployment, old age, and health insurance, including insurance for injuries which are not industrial . . . The charge to industry of the cost of workmen's compensation should not be united with other types of social insurance. Workmen's compensation should be an obligation of industry; other types of social insurance, if undertaken, should be an obligation of society, of which industry is but a part."

As a standard work of reference for many years to come, Dodd's work will probably be the most used in reference to the problems of compensation in their medical, legal, and insurance phases.

The book contains 862 pages, is bound in cloth, is published by The Commonwealth Fund, 41 East 57th Street, New York City, and is priced at $4.50.

Practice of Medicine

IN THESE days of emphasis on specialties, and the flooding of the book market with volumes on highly specialized subjects, it is refreshing to run across a well-written treatise on the practice of medicine intended not for the specialist but as well for the student and practitioner, and giving guidance in the solving of numerous problems with which they are daily confronted.

The author, DR. JONATHAN CAMPBELL MEAKINS, Professor of Medicine and Director of the Department of Medicine, McGill University, well points

out: "So far as the patient is concerned, disease consists of symptoms. It is for these that he or she consults a physician. They represent the earliest manifestations of disease and are, therefore, of primary importance. They are the clues to the clinical riddles. For this reason they have been given particular prominence, and where possible their causation has been described and their significance has been pointed out . . . I have kept before my mind the fact that the patient presents symptoms and signs which indicate disturbances of function and from these the pathological conditions may be traced and identified. It has been my hope that this book would be a guide to the practice of medicine as well as a description of individual diseases."

The various chapter headings, for the most part divisions of the diseases considered into systems or portions of the body, reflect the method of handling the material by the author: An Introduction to the Practice of Medicine—Diseases of the Nasopharynx and Mouth—Specific Infections of the Nasopharynx and Mouth—Diseases of the Respiratory System—Diseases of the Lungs—Diseases of the Circulatory System—Diseases of the Serous Membranes, Mediastinum and Diaphragm — Diseases of the Hematopoietic System—Diseases of the Gastro-intestinal Tract—Diseases of the Liver and Bile Passages—Diseases of Nutrition—Diseases of Metabolism — Diseases of the Ductless Glands—Diseases of the Nervous System—Diseases of the Locomotor System—Diseases of the Urinary System—Infectious Diseases Conveyed by Parenteral Inoculation—Diseases Due to Allergy —Diseases Due to Abnormal Environment—Diseases Due to Chemicals and Drugs.

Of particular interest to the industrial physician and surgeon is the material on Diseases Due to Abnormal Environments, which includes heat, cold, high barometric pressure, low oxygen pressure, carbon monoxide, cyanides, benzol poisoning, other gas poisons, seasickness, submersion, the effects of radium and x-ray, and the effects of electric shock.

Of the information relative to Chemicals and Drugs, there have been included ethyl alcohol, various alcoholic syndromes, methyl alcohol, ginger paralysis, opium, cocaine, lead, barbiturates, mercury, arsenic, petroleum or gasoline, ergot, food infection, food intoxication, botulism, allantiasis, and snake bites.

Of the features of the book are the lists of references at the end of each chapter and also the well selected and reproduced illustrations which number 505, including 35 beautifully colored plates.

The volume is one which may be used as a valuable reference guide in the library of every physician, whatever type of medicine he may be practicing.

The book contains 1343 pages, is published in 1936 by the C. V. Mosby Company, St. Louis, Missouri, and is priced at $10.00.

The Pneumonokonioses (Silicosis)

BOOK III of this Series, just published this year, includes the literature and laws published during 1935-1936 in the United States and foreign countries. Part I of this volume includes abstracts of articles published during this period, and Part II consists of the occupational disease laws pertaining to this subject which are now in force in the United States and several foreign countries.

The abstract portion of the new volume contains 701 digests of articles and papers, both domestic and foreign.

It will be noted in this new volume of the Series that a great deal more material has been taken from trade journals and similar publications, thus widening the scope of the material, and giving the reader an opportunity for a greater extended variety of lay opinion than characterized the other two books.

A short bibliography of abstracts which were omitted from the former books is also included in this issue, containing almost entirely a group of foreign references.

The volume is provided with an author index which is of considerable value in locating the writings of any particular investigator.

The Medical Index allows the reader to locate references under various subject headings, and is of particular value to those desiring information on specific phases.

Not the least of the appealing characteristics of this volume is the digest of laws of the United States and foregin countries, including information relative to the existence or non-existence of an occupational disease act—pertinent points in decisions under such an act—whether occupational diseases are covered by the compensation act of the state and pertinent decisions in regard to such an act—as well as the existence or non-existence of statutes referable to health and safety, including decisions having applicability to occupational diseases cases.

As to the character of the abstracts, masterful paraphrase has again been use, and with telling effect.

In the words of our previous review of Volume II, of this series:

"The compilers and abstractors have proved beyond question that abstracting is as much an advanced art as writing; subtlety of expression, humorous allusions, ironic appraisal of style, and the fine ability to discriminate with keen-edged insight between the real and apparent combine to make the reviews a real collection of the 'fine art of abstracting,' and appealingly readable and entertaining, as well as instructive."

The compilation will be of great value to all of those who have to deal with problems relative to occupational diseases, but especially to physicians, attorneys, and engineers whose duty it is to keep thoroughly informed and to apply specific information to the peculiar slants of medicolegal cases as they arise.

Book III contains 1033 pages, more than twice the number of either Book I or Book II.

The price of Book III is $8.50.

Any combination of two of the three books is priced at $15.00, and the three books sell for $20.00.

This book is published by the Chicago Medical Press, 302 South Canal Street, Chicago, Illinois.

The authors as before are GEO. G. DAVIS, M.D., F.A.C.S., ELLA M. SALMONSEN, Medical Librarian, and JOSEPH L. EARLYWINE, Attorney.

The Treatment of Burns

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THE treatment of burns is such an extensive subject that only a general outline can be given in this paper.* The clinical, pathological and therapeutic observations, omitting surgical interference, will be limited to thermic injuries.

A burn has been described as an injury inflicted on the body by a degree of heat higher than is compatible with healthy action in the part affected. There are two types of such trauma, that produced by dry heat and scalds by moist heat. Any substance whether gas, liquid or solid, which radiates much heat will produce a burn. The depth or type of trauma will therefore depend upon the degree of temperature and the length of application.

Anatomy: According to Gray's Anatomy: "The skin is the principal seat of the sense of touch and may be regarded as a covering for the protection of the deeper tissues; it plays an important part in the regulation of the body temperature and is also an excretory and absorbing organ. It consists principally of a layer of vascular tissue, named derma, corium or cutis vera, and an external covering of epithelium termed epidermis or cuticle." Epithelial structures, hair follicles, sebaceous and sweat glands lie in the cutis and subcutaneous tissue.

Classification: There are many suggested classifications of burns. That outlined by Dupuytren deals with the depth of tissue invaded or destroyed. There are six degrees in his classification:

1. Erythema of the skin;
2. Vesication;
3. Destruction of the cuticle and part of the cutis vera, the papillary tips remaining intact;
4. Destruction of the entire integument and part of the subcutaneous tissue;
5. Encroachment on muscles; and
6. Charring of tissue.

There should be another classification embodying the extensiveness of the injury in terms of percentage of the body surface involved. This could be a more or less fixed classification. There is no one degree in the ordinary thermic injury, as there will be present many degrees in different parts of the area involved.

Pathology: Both systemic disturbances and local trauma follow burns. The tissue changes are in proportion to the depth of the burns, and the systemic disturbances are in proportion to the depth and extensiveness of area involved.

Regeneration of the superficial skin takes place perfectly when the invasion does not occur deeper than the papillary layer. When the corium has been damaged and when infection takes place, scarring will result.

The destroyed normal skin is replaced by fibrous tissue, poor in blood supply, elastic tissue is imperfectly replaced, and the epithelium and glandular structures are gone forever. The result after healing may be hypertrophic scars and contractures.

Systemic: The chief systemic disturbances that may follow a severe burn are concentration of the blood and lowered blood pressure, and definite changes in the kidneys, suprarenal glands, spleen and liver and focal necrosis of the bone marrow are occasionally observed following fatal burns. Owing to the concentration of the blood, there is an immediate increase in the erythocytes and the leucocytes. If the latter are increased in greater proportion to the red cells, it is assumed that this is due to toxemia. The direct cause of blood concentration is a changed permeability of the capillary wall. The fluid loss from the blood is plasma. The non-protein nitrogen in severe burns is increased 25% to 50%. The sodium chloride content is lower, due to its retention in the tissues and their loss through the burned area. A certain unknown toxic substance is absorbed by the living tissues from the damaged skin. The amount of toxins absorbed is probably in proportion to the area involved. Hence it is so important to thoroughly cleanse a burn as quickly as possible.

Complications: The complications of thermic injuries are both dermal and systemic. The dermal complications are mostly infection and scarring. The most important systemic ones are erysipelas, pyemia, tetanus, pneumonia, and the so-called duodenal ulcer of Curling. Should the ulcer develop, perforation and hemorrhage and even death may result. The cause of this terrifying symptom may be due either to the absorption of toxins or to the lodgement in the duodenum of emboli originating in the burned area.

Prognosis: The prognosis in burns depends upon the following factors: the general health of the individual, the age, the depth and extensiveness of the burn, the region of the body invaded. The area involved is more important than the depth. According to Pack, "All burns of the first degree are fatal if two-thirds of the body surface is involved; all burns of the second degree, if one-half of the body surface is involved; all burns covering one-third of the body surface are extremely serious, if not immediately fatal." The degree of the concentration of the blood largely determines the outcome. Shock and toxemia are the chief causes of death.

Symptoms: The symptoms and diagnosis of burns are too well known to warrant discussion. The all important fact is to recognize systemic symptoms early or to anticipate their appearance. Shock, high fever, vomiting, convulsion and toxemia may develop.

Systemic Treatment: The marked drop in death rates from extensive burns, I believe, is due more to correct systemic treatment and after-care than to the use of tannic acid. Pain and shock are the most important symptoms to treat. These should be controlled before local treatment is instituted. Rest, external heat, elevation of the foot of the bed, and intravenous administration of fluids together with an opiate, seem to be the conventional procedure. The administration of fluids will tend to overcome shock and combat dehydration. After the patient has recovered from the primary shock, cleansing of the area should be commenced. Both patient and physician are saved many disagreeable hours if this procedure is quickly and carefully done. General anesthetics should never be given if there is any possible way to avoid it. There are too many hazards associated

* Read at the Annual Meeting of the Association of Surgeons of the Southern Railway, Jacksonville, Florida, June 8, 1937.

with their administration in severe burns. Morphine is the ideal hypnotic and sedative. The cleansing of the burned area is a painstaking ordeal. The results depend so much on this procedure. I find it best to mechanically remove destroyed tissue, though it takes much time, rather than to rely on a sponge soaked in soap and water and probably the addition of a strong antiseptic. The irritated, inflamed and exposed nerve ends cannot withstand further damage by the application of water and soap and strong antiseptics. Normal saline solution is much better. I find it best to collapse simple blisters rather than to remove the entire elevated skin. This latter acts as a natural covering provided there is sufficient drainage. A most important point that should not be overlooked is the administration of tetanus antitoxin in extensive burns. When the patient has overcome the primary shock and is reasonably comfortable and the local area is cleansed, the next step is the application of some medicant.

TREATMENT: Ever since the dawn of civilization, man has been trying to find a perfect local application for burns. None has so far been found, and the writer is of the opinion that there is no specific treatment for the ordinary thermic trauma and that the local pathology should be treated as any other surgical lesion. There have been many and sundry local applications advised for the relief and regeneration of the injured skin. I have reviewed many original articles dealing with the local treatment of burns and find almost as many remedies. The most popular treatment at present seems to be the cleansing of the caloric injury, application of an antiseptic, following by the application of tannic acid in some vehicle. It would be a waste of time to discuss the many remedies that have in the past been used, as experience has proved that they are unsatisfactory. Tannic acid, mercurochrome, gentian-violet, ferric chloride and silver nitrate are recommended to produce a coagulum. I have had no experience with either silver nitrate or ferric chloride; therefore my remarks will be confined to the treatment ordinarily used in my practice. About 10 years ago Dr. E. C. Davidson, of Detroit, introduced a new method of treating burns by the use of tannic acid in solution. Very quickly thereafter the basic principal of coagulation became more or less universal. The original method of Dr. Davidson has been modified many times. For instance the strength of the aqueous solution has been used in dilutions from 1% to 20%. Its application varies from once to a continuous drip. Tannic acid is also applied in the form of ointments, using many different bases and varying degrees of strength. The number of applications varies from one to many. It therefore seems quite clear that, even if the basic principal of coagulation were ideal, in 10 years, with thousands of doctors treating many hundreds of thousands of burns, a satisfactory conventional modification would have been found.

The coagulum produced by the application of tannic acid is coarse and tough and is impossible to remove without producing considerable bleeding and intense pain. Furthermore, it furnishes ideal conditions for the formation of pus. This pus may spread over a large surface before it is observed, as it cannot penetrate through the thick coagulum. If not observed quickly, it will ooze out around the edges only after considerable young epithelium has been destroyed. If this tough and coarse coagulum needs to be removed it will leave a bleeding surface bathed in pus. There will be seen coarse granulations, and the presence of these generally means scarring. To my mind, such a system of treatment is far from ideal. A further important objection to tannic acid in aqueous solutions is that it is unstable and must be prepared only for immediate use. Again, in the region of a joint, early mobilization may be prevented because of the toughness and non-elasticity of the coagulum. Tannic acid applied to normal tissue will produce destruction. The application of tannic acid would be ideal if it produced a flexible coagulum, especially around joints, and if there was no drainage and no infection. It does not fulfill any of these three requirements. It does, however, furnish a satisfactory protecting covering. The now universal use of tannic acid should not be condemned any more than any of the other measures recommended. Most every physician has case records showing spectacular results both from the use of tannic acid and other coagulants as well as from non-coagulating medicants. My experience with the use of tannic acid in strong aqueous solution has been bad. There is produced rather quickly a hard, tough, inflexible coagulum which harbors infection underneath and which is difficult and painful to remove. I have had much better results with the use of 5% tannic acid carefully incorporated in yellow vaseline. Great care must be exercised in the mixing, and each supply must be made just prior to its use. This is applied rather often following the initial cleansing. The burned area is not cleansed for several days. After there has accumulated some hardened discharge the wound is carefully cleansed with a very weak solution of Lysol. With this method I do not often produce the hard and tough coagulum. A local antiseptic is not applied until needed. All of you have seen horrible infections take place in extensive burns, even after an antispetic was applied early. Their application must add injury to an already damaged surface. Certainly there is no way to completely sterilize the wound without serious consequences.

A splendid treatment, using mercurochrome both as antiseptic and coagulant, is outline by Dr. Alfred C. Turner in the November 23, 1935, issue of the *British Medical Journal*. It deserves the careful consideration of all concerned in the treatment of burns. Certainly it has far greater germicidal properties than tannic acid.

The presence of pus under a tough, coarse, nonelastic tannic acid coagulum is both painful and dangerous to the patient and disturbing to the physician. Certainly the application of a conventional antiseptic is of no value. Free drainage must be made available to prevent further erosion of the germinal layer and to prevent further toxemia. Incision offers very little drainage. The entire removal requires a general anesthetic, and this may produce bleeding. The procedure of choice in this instance is flax seed meal poulticing, the poultice to be changed in from two to six hours depending upon the amount of drainage. If the pus is rather profuse, wet dressings of 0.5% freshly made

Dakin's solution together with a daily application of 2% to 4% mercurochrome is advisable. If the poulticing is continued for a week or 10 days the results are gratifying. All drainage ceases. The raw and bleeding area is covered with fine healthy granulations and the wound is generally cleaned up. So spectacular have been some of the results that the writer commenced using flax seed following emergency treatment. I suggest for your consideration and trial the use of this old fashioned remedy, and I believe you will not be disappointed. It fulfills the triple requirements of a local application for thermic injury, namely, it is mildly antiseptic, allows drainage, and gives adequate covering.

Conclusion: The natural course of events with a severe burn is primary shock, dehydration, and infection; and treatment should be instituted to combat them.

General anesthetics should be avoided.

The burned tissues should be mechanically removed rather than with soap and water or ether.

There is no specific treatment for burns, and they should be treated as any other surgical lesion.

The best medicant to apply to a burn would be one that is antiseptic, one that allows drainage, and one that provides a satisfactory covering.

Employee Examinations

Hart E. Fisher, M. D., F.A.C.S.,
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INDUSTRIAL MEDICINE, regardless of the nature of the industry in which employee health conservation is concerned, consists for the greater part in preventive measures, while therapeutic measures are the lesser objectives.

Preventive medicine attempts to visualize physical conditions in the employee and institute corrective measures before injury or illness actually occurs.

The anchor of employee health conservation in accident and sickness prevention is derived from pre-employment, periodical, non-periodical and exit examinations of employees within the industry.

Many Industrial Medical Departments operate under the mistaken idea that their greatest value to their employees lies in the care of employees injured in line of duty and give little, if any, real effort toward absenteeism from duty on account of sickness.

The belief has been too much that the employees' state of health is their personal concern and that it should be left to their discretion to maintain themselves in a state of physical perfection, and that industry would be usurping the prerogatives of the employee's family medical advisor if industry should put into operation a policy of employee health conservation.

There would be very little need for organized medical departments if we were concerned only with the care of employee injuries, as the accident prevention work done in the past two decades has reduced the frequency and severity rate of employee accidents to the point where this class of traumatic surgery could be well taken care of by the medical profession outside the industry and in many instances more efficient and economical service would result.

Industry is vitally interested in the health of its employees and the profits and success accruing to any employees are in proportion to the health of the employee group regardless of the size of personnel.

Employee illness is an expensive item of plant operation, as is shown by the fact that the lost man-hours from illness in any industry are far greater in number than those from accidental injury.

Industry should be interested in employee health, and should give every possible assistance to the employee in aiding him to maintain physical fitness.

IF INCIPIENT disease or physical defects in an individual would actually cause pain and discomfort, the average employee would of his own initiative seek medical knowledge and advice as to his condition. But such is not the case. Many persons have serious physical conditions present, of which they have little or no knowledge; and by the time their trouble is advanced to where the individual actually has pain and seeks medical aid, the disease may be so far advanced as to be incurable, or amenable to treatment only after a prolonged and expensive course of medical service and lost work. Therefore, industry, by its various forms of medical examinations, pre-employment, periodical, non-periodical and exit from service, aids materially in uncovering physical defects and insidious disease conditions in the employee, giving that employee the opportunity of correcting the same before the defect becomes more serious.

Pre-employment examinations should be for ascertaining the physical fitness of the applicant for employment within a given industry for the work that he is to perform within that industry in a manner that is safe and efficient both for himself and his fellow worker, and, in the event his work brings him into contact with the public, the customers of his employer. Pre-employment physical examinations are, and rightfully should be, to fit the worker properly into the job which his physical qualifications warrant, and should not be used to weed out defective workers, but only to aid them in finding their proper place in industry.

After employment, time must necessarily elapse before employee health comes under observation by industry; and, with a definite policy of employee health conservation, the periodical medical examination finds an important place in plant operation. Many physical defects and disease conditions develop after employment, and re-examinations of the employee personnel held at intervals determined as best for each particular industry, give health security to employer and employees alike.

The non-periodical examinations are those that are desired to determine an employee's state of health in the event of transfer to different work, promotion to a new job, and following absenteeism from work on account of accident or illness,

MEDICAL EXAMINAT

PRE-EMPLOYMENT

Applicants for Employment

All classifications of employment
(Water-boy to President)
For the prevention of entrance into the service of physically unfit employees, and
To have assurance that those employed are physically fit for the work they are asked to perform.

Benefits to Industry-Company-Employer:

Eliminates entrance of potential human liability.
Assures healthy personnel.
Improved efficiency of work assures satisfactory product.
Reduces labor turnover.
Promotes safety.
Prevents entrance of industrial disease.
Reduces frequency and severity rate of accidents.
Improves employee relations (Morale).
Reduces absenteeism from work on account of sickness.
Reduces burden of employee sick benefits.
Prevents fraudulent claims for pre-existing diseases or defects.
Delays pension costs.

Benefits to Fellow Employees and the Public (Customers):

Reduces the possibility of accident due to physical incapacity (man failure).
Protects fellow employees and the public from communicable disease.
Insures reasonably safe service to the public.
Promotes good public relations.
A well employee is a courteous worker.
Public is assured of safe and efficient service.

Benefits to Employee:

Provides health security.
Prevents individual from engaging in work which would be dangerous to him.
Improves confidence in own physical fitness.
Insures continuity of service.
Reduces medical expense by detection of insidious disease before disability.
Is a factor in building up good employee relations.
Increases life expectancy (Longevity).

PERIODICAL MEDICAL

A Medical Examination Held at Regular Intervals According to Personnel Needs.

This to detect physical and mental defects and institute remedial measures.

Sick and Health Benefits Insurance

Includes examination for admission to m
and in connection with claim for insu
other benefits

Benefits to Industry-Company-Employer:

Protects against undue expenditures and conserves the pension fund.
Guards against fraudulent claims.
Reduces the cost ratio of insurance.

Benefits to Employee:

Assists the employee to obtain the benefits due him.
Aids in reducing the medical costs to himself.

Applicable to Those Receiving Promotion Those being Transferred from One Department to Another.

Applicable to transportation employees
cerned with actual train operat

Benefits to Industry-Company-Employer:

Provides assurance that only physically fit are placed in responsible positions.
Tends to preserve full working capacity.
Guards against fraudulent claims.

Benefits to Employee:

Prevents undue exposure to risk.
Increases period of useful service, by the detection of incipient disease.
Prevents promotion and subsequent demotion of employees and thus avoids a cause of discontent.

Employees Engaged in Hazardous Employment (including those employees who are exposed to industrial disease hazards):

Applicable to employees where man failure endangers self, fellow employees, and the public (customers).

Benefits to Industry-Company-Employer:

Ascertains physical condition of persons entering service prior to establishment of pre-employment examinations.
Tends to assure more healthful working force.
Advances efficiency and production.
Delays pensioning of old employees.
Reduces accident severity rate due to physical incapacity.
Prevents fraudulent claims on account of pre-existing physical defects.
Aids in detection of accident-prone employees.

Benefits to Fellow Employees and the Public (Customers):

Increases period of gainful occupation, due to the detection of incipient disease conditions.
Decreases liability of accident due to physical incapacity.
Encourages good public relations, and assures public of safe and efficient service and contact.
Assures safe and healthy personnel.
Invites patronage from the public.

Benefits to Employee:

Reduces cost of sickness and health insurance.
Increases life expectancy.
Prevents development of disabling disease.
Promotes safety at work—on the highway—in the home.
Aids in the reduction of future medical expense.
Reduces absenteeism from work on account of sickness.
Insures family and dependents a more stable economic security.

Those Engaged in Non-Hazardous Employment:

Applicable to office clerical personnel, and all others engaged in more or less sedentary occupations;
All labor classifications that have no direct contact with industrial hazards.

Benefits to Industry-Company-Employer:

Protects against public criticism and possibility of claims.
Guards against fraudulent claims by employees on account of physical incapacity
Lessens absenteeism from work on account of sickness.
Increases working capacity of personnel.
Promotes safe, efficient work and improvement of product.
Assures better employee relations
Reduces cost of sick and health insurance.
Reduces labor turnover, lessens substitution, postpones pensioning and retirement.

Benefits to Fellow Employees and the Public (Customers):

Protects fellow employees and public against communicable disease.
Lessens liability to spread of disease
Promotes good public relations.
Public has confidence in safe, efficient service by healthy employees.
Incentive to use of product or service.

Benefits to Employee:

Produces a better state of physical health.
Reduces lost time and lost wages due to absenteeism on account of sickness.
Improves and prolongs working capacity.
Less liability to accident-proneness.
Promotes economic security for self, family and dependents by reasonable assurance of freedom from disabling disease.
Reduces the cost of being sick, by detection of early signs of disease.

XAMINATION

NON-PERIODICAL MEDICAL
(Including Exit Examination of Employees Leaving Service of Company)

Health
nsurance
for admission to membership, th claim for insurance and er benefits.

to Employee:
employee to obtain benefits due him. ucing the medical to himself.

Benefits to Fellow Employees and the Public (Customers):
Conserves the funds of the benefit organization, and guards against fraudulent claims.

Those Presenting Themselves for Sick Leave, Retirement or Exit from the Service.
Applicable to those eligible for pension or retirement annuity;
Those requesting sick leave or other leave of absence;
Those returning to work after leave.

Benefits to Industry-Company-Employer:
Minimizes the cost of ill health more particularly as to those who are growing old in the service.
Reduces the possibility of retiring an employee before his economic usefulness has been saved both for the company and himself.

Benefits to Employee:
Assists in making the best arrangements possible for the individual, considering his age, length of service, and state of health.
Employee receives the rights due him.
Only physical incapacity determines his further economic status in industry.

Benefits to Fellow Employees and the Public (Customers):
Guards against the danger of accidents due to physical incapacity.
Assures courteous and efficient service.

Receiving Promotion, and to red from One Position to other.
rtation employees not contual train operation.

Those Referred by Department Supervisors or Department Heads—
Suspicious of physical or mental condition of employee because of: unusual occurrences, peculiar mental reactions.
Employees who come of their own volition.

o Employee:
due exposure to risk.
eriod of useful the detection of nt disease.
notion and subnotion of emthus avoids a discomfort.

Benefits to Fellow Employees and the Public (Customers):
Guards against accidents due to physical incapacity.
Assures the public that the new face in the cab is as safe as the old.

Benefits to Industry-Company-Employer:
Provides necessary decision as to physical fitness of the employee for his position.
Guards against fraudulent claims.
Protects from injury both the employee and the public.

Benefits to Employee:
Provides definite information as to his own physical condition and aids in adjustment to his work.
Prevents injury to self and those about him.

Benefits to Fellow Employees and the Public (Customers):
Guards against accidents due to physical incapacity.
Protects fellow employees and the public from communicable diseases.

Compensation Other Claim Cases Litigation
All persons referred by the Legal Department, and persons sent by the Claims Department.
Employees returning to work after an injury.
Employees leaving the service of the company.

Benefits to Industry-Company-Employer:
Furnishes necessary medical data for Legal and Claim Departments.
Prevents fraudulent claims after separation from the service
Provides prompt reports for compensation authorities.

Benefits to Fellow Employees and the Public (Customers):
Protects against employees who have become physically unfit resuming duty in positions where their unfitness would be hazardous to others.
Assures the public that it will be served with reasonable service in a safe and efficient manner.

Benefits to Employee:
Prevents resumption of work which has become dangerous for the injured individual.
Assures that he is physically fit for the work that he is doing.
Assists in rehabilitation, vocational training, and placement following injury.

BENEFITS
to
Employer and Employee
of
Pre-Employment, Periodical, and Non-Periodical
MEDICAL EXAMINATION
of
Employees

or from ordinary leaves of absence from any cause. Where employee morale, efficiency, work errors, and conduct are below the individual's daily ability, this should lead the foreman or supervisor to seek assistance from the Medical Department—a non-periodic examination to ascertain if the cause is illness or physical defects of one nature or another.

The exit examinations, as used in industry in the past, were mainly for the purpose of preventing fraudulent employee claims for alleged injury or occupational disease, following severance from service. In fact, those employees undergoing exit medical examinations from an industry have been greatly benefited as to their future by having physical defects and insidious disease brought to their attention through this procedure.

I HAVE, through the medium of the accompanying chart on medical examinations, endeavored to give in graphic form, this important phase of employee health conservation. True, it is not complete in every respect, nor does it cover all phases of benefits accruing to the employee, fellow employee or customers in all work classifications. But information can be secured from it which, I am confident, will aid in the clarification of the value of medical examinations in industry.

This chart is not original with this author, but is a modification of a similar chart edited by Dr. John McCombe, Chief Medical Officer of the Canadian National Railways, Montreal, Quebec, some 10 years ago. I have enlarged the scope of examinations and added what, to my mind, is information bringing it up to meet the changes of the present day. Should the chart be of value to executives, doctors and personnel officers, I sincerely trust that they in turn will bring to my attention those factors that I may have overlooked in drawing it up.

Shock--Present-Day Conception and Treatment

Wm. H. Prioleau, M.D., F.A.C.S.,
Charleston, South Carolina

THE TERM shock has for a long time been generally used to denote a condition of lowered vitality resulting from various causes.* Accordingly its meaning has been anything but definite. This was a natural consequence of a lack of knowledge concerning its nature. However of late a great deal of clinical observation and experimental work have resulted in the recognition of a definite clinical syndrome to which the term should properly be limited. This syndrome is characterized by a disparity between the circulating blood volume and the functioning capacity of the vascular bed—in other words, the blood volume is insufficient to fill the blood vessels. Such a condition is brought about by a reduction in the blood volume, or an expansion of the vascular bed, either singly or in combination.

The persistent decrease in blood volume is the most characteristic feature of shock. It is recognized by an increase in the red blood cells and hemoglobin. This hemo-concentration can be brought about by various processes, such as the loss of water and salt in vomiting, diarrhea, excessive sweating, and abnormal kidney secretion, the loss of fluids in surgical drainage, and from burned surfaces, the exudation of serum into injured tissue, and the leakage of plasma through the walls of injured capillaries.

The other factor in the disparity is the expansion of the vascular bed. This has been shown to be in the capillaries and venules, and not in the arteries. This is the result of damage to the vessel walls by toxins of various nature. Sympathetic nervous system and endocrine disturbances are no doubt factors in some cases.

The clinical picture of shock is familiar to all of us—prostration, cold extremities, pinched facies, pallor, sunken eyes, sweating, pulse small and rapid, low blood pressure.

Later the kidneys fail to function, with resulting nitrogen retention and disturbance of the acid base equilibrium.

At postmortem examination the heart is small, the spleen is dry. The other organs are congested; there is cloudy swelling and ecchymosis, the result of the capillary walls being permeable to fluids (plasma). The peripheral arteries are contracted, while the veins and capillaries are congested. Edema of the lung is common.

THERE are several conditions from which shock must be differentiated. An important one is hemorrhage, which is often a contributing factor, though in itself it does not necessarily produce shock. In hemorrhage the blood concentration is lowered and the volume is readly restored by fluids. In shock the blood concentration is increased and fluids are relatively ineffective due to the permeability of the capillaries. In hemorrhage the tissues are anemic, in shock congested.

Shock must be differentiated from cardiac failure, the former being by far the greater danger in surgery. In shock hemo-concentration precedes circulatory failure.

Syncope is at times termed primary shock. In this condition there is no hemo-concentration or congestion. It may occur after fright, grief, pain, or minor physical injury. It is likely a vasomotor phenomenon. It is not characterized by capillary permeability.

As with many other conditions, shock is prevented more effectively than it is treated. In accident and operative cases the loss of blood must be reduced to a minimum—when any amount is lost, blood transfusion should be given. The fluid and salt intake must be adequate to make up for excessive losses such as occur in diarrhea, vomiting, profuse sweating, and abnormal output of water and salts by the kidneys in various metabolic disturbances and from burned surfaces and exudation into the tissues.

Conditions which tend to injure the walls of the capillaries, resulting in their dilatation and fluid loss into the tissues—such as toxemias, poisoning, infections, metabolic disturbances and asphyxia—must be effectively combated, preferably at their source.

It is well recognized that operative trauma and prolonged anesthesia are productive of shock. Accordingly tissues must be handled gently and

* Read at the Annual Meeting of the Association of Surgeons of the Southern Railway, Jacksonville, Florida, June 8, 1937.

the abdominal viscera not unduly disturbed by manipulation and gauze packing.

Contributing causes may be very important and must not be neglected. Fear must be allayed, pain relieved—likewise cold and fatigue. It will be noted that drugs so far have not been mentioned except as they may be used in the relief of pain—or in the correction of metabolic disorders, such as insulin in diabetes. Drugs as such have very little effect in the relief of shock—at times the so-called stimulants may be harmful. Adrenalin constricts the arterioles, but they are already abnormally narrowed in a compensatory effort to reduce the size of the vascular bed. The heart is not at fault, so stimulating this organ is of limited value.

ONCE shock is well developed our main reliance must be upon increasing the blood volume.

Glucose and saline solutions have an immediate effect—but it is of short duration as they soon pass out of the circulation into the tissues, or are excreted by the kidneys. Acacia solutions, due to their colloidal nature, remain in the circulation much longer. They may be very effective, but their administration is not altogether without danger.

Transfusion of whole blood is undoubtedly the treatment of choice.

Providing that the condition of shock is not too far advanced it will result in a sustained increase of pulse volume.

Direct efforts to decrease the size of the vascular bed are of limited value. Especially is this the case with drugs.

However a most effective measure is that of placing the patient so that the head is lower than the feet. This increases the all important circulation to the brain. Bandaging the extremities so as to decrease the amount of blood in them has a similar effect.

Failure of the stomach to empty is not uncommon and must be watched for. It is relieved by an inlying small stomach tube with continuous suction.

SUMMARY: Shock is a disparity between the circulating blood volume and the functioning capacity of the circulatory bed.

It may result from various causes.

In treatment the main reliance is to be placed upon increasing the blood volume.

For this purpose the transfusion of whole blood is most effective.

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Association Meetings

Society of Plastic and Reconstructive Surgery

THE Society of Plastic and Reconstructive Surgery is holding its annual meeting in St. Louis, Missouri, on October 22 and 23, in conjunction with the Inter-State Post Graduate Medical Association of North America. Dr. C. R. Straatsma, New York City, is Program Chairman.

Academy of Physical Medicine

THE 15th Annual Meeting of the Academy of Physical Medicine will be held at the Hotel Walton, Philadelphia, October 19, 20, 21, 1937. The Academy, which is international in scope, will present a scientific program based on reports of the most recent research and practice of the various specialties. In addition to the lectures, demonstration clinics will be held at the hospitals of the University of Pennsylvania, Jefferson Medical College, and Temple University. A copy of the program may be had by addressing: William D. McFee, M.D., Chairman, Committee on Program and Publication, 41 Bay State Road, Boston, Massachusetts.

Mississippi Valley Medical Society

THE third annual meeting of the Mississippi Valley Medical Society will be held at Quincy, Illinois, September 29, 30, October 1. A most ambitious program has been arranged consisting of 48 teachers and clinicians who will give over 60 lectures and demonstrations in the three-day intensive session. The first day will be an All-St. Louis program with 18 clinicians on the program; on the second day there will be groups from Rochester and Chicago; on the third day the speakers will come from a wide territory. An innovation this year will be two short courses of instruction, (four hours each)—one on "Surgery of the Neck," by Dr. Lindon Seed, Associate Prof. of Surgery, University of Illniois College of Medicine, and another "Interpretation of Clinical Laboratory Findings" by Dr. M. Pinson Neal, Prof. of Pathology, University of Missouri School of Medicine. At the annual banquet to be held on September 30, the speakers will be Dr. R. K. Packard, President, Illinois State Medical Society; Dr. D. C. Conley, President, Missouri State Medical Society and Dean of the University of Missouri School of Medicine; Dr. E. M. Myers, President of the Iowa State Medical Society; and Rev. A. M. Schwitalla, Ph.D., Dean of St. Louis University School of Medicine. There will be large technical and scientific exhibits. A complimentary stag supper will be given on September 29. The meeting is open to all ethical Physicians. A detailed program may be obtained from Dr. Harold Swanberg, Secretary, 209-224 W.C.U. Building, Quincy, Illinois.

American Public Health Association

THE American Public Health Association announces that its 66th Annual Meeting will be held in New York City, October 5-8, 1937. A large eastern membership will receive that information with satisfaction. Not since 1921 has the Association met in the world's greatest city. The 65th Annual Meeting took place in New Orleans in October. It attracted an attendance of 1650 health

authorities representing 45 states, and Canada, Cuba ,Mexico, and nine other foreign countries. The officers of the Association are reminding themselves of this registration in a state where the membership numbers less than 100 and asking themselves what the registration will be in New York City where the membership counts up to nearly 500 within the city limits alone. An overnight's ride will enable more than one-half of the Association's 5000 members to attend the convention.

The NATIONAL ORGANIZATION FOR PUBLIC HEALTH NURSING will meet with the AMERICAN PUBLIC HEALTH ASSOCIATION in 1937 for the first time. This large and important organization is expected to add another thousand to the registration lists.

The following related societies will meet with the Association as usual:

THE AMERICAN ASSOCIATION OF SCHOOL PHYSICIANS;

INTERNATIONAL SOCIETY OF MEDICAL HEALTH OFFICERS;

CONFERENCE OF STATE SANITARY ENGINEERS;

CONFERENCE OF STATE LABORATORY DIRECTORS;

ASSOCIATION OF WOMEN IN PUBLIC HEALTH; and

DELTA OMEGA.

Association of Military Surgeons

THE Pacific Fleet will be in the port of Los Angeles during the Convention of the Association of Military Surgeons on October 14-16, 1937, at the Ambassador Hotel. An unusually interesting program has been prepared and the Scientific and Technical exhibits will be the largest in the history of the orgnanization.

Physicians, surgeons, dentists, and veterinarians of the Army, Navy, Marine Corps, C. C. C. Camps, and the Veterans Administration will be present.

American Academy of Orthopaedic Surgeons

THE first West Coast meeting of the American Academy of Orthopaedic Surgeons will be held on January 16-20, 1938 at the Hotel Biltmore, Los Angeles.

Special trains will be run with stop-overs at Santa Fe, the Grand Canyon, San Francsico and other points.

Occupational Disease Symposium

—Northwestern University Medical School—
—September 27 and 28, 1937—

NORTHWESTERN UNIVERSITY is conducting a symposium on industrial disease and hygiene on September 27 and 28, 1937. The program is designed to cover some important and timely phases of the occupational disease problem.

The subjects are to be treated by well informed nationally known speakers.

Registration will be limited to physicians and executives actively interested in industrial disease. The registration fee for the scientific program is $5.00. A charge of $3.50 will be made for the Banquet session at which the Honorable Frances Perkins will speak.

PROGRAM

Scientific Session

SEPTEMBER 27, 1937—MORNING SESSION

9:00 A.M.

"Introductory Remarks"—IRVING S. CUTTER, M.D., Dean of the Medical School—Associate Professor of Medicine Northwestern University, Chicago.

"The Role of Allergy in Industry"—SAMUEL M. FEINBERG, M.D., Assistant Professor of Medicine, Northwestern University Medical School, Chicago.

"The Role of Allergy in Industrial Dermatoses"—MARION B. SULZBERGER, M.D., Assistant Professor of Clinical Dermatology and Syphilology, New York Post Graduate Medical School, Columbia University, New York City.

AFTERNOON SESSION

1:30 P.M.

"Some Phases of the Pathology of Silicosis"—LEROY U. GARDNER, M.D., Director of the Saranac Laboratory for the Study of Tuberculosis, Saranac Lake, New York.

"The Healthy Chest and the Modifying Influences of Silicosis with Infection"—EUGENE P. PENDERGRASS, M.D., Assistant Professor of Radiology, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania.

SEPTEMBER 28, 1937—MORNING SESSION

9:00 A.M.

"Toxicology of Industrial Solvents"—CLARENCE W. MUEHLBERGER, PH.D., Lecturer in Pharmacology and Toxicology, Northwestern University, Chicago.

"Some Recent Developments in the Field of Industrial Solvents"—ALICE HAMILTON, M.D., U. S. Department of Labor, Washington, D. C.

AFTERNOON SESSION

1:30 P.M.

"Industrial Lead Poisoning"—ROBERT A. KEHOE, M.D., Associate Professor of Physiology, University of Cincinnati, College of Medicine,

"Round Table Discussion"—JAMES A. BRITTON, M.D., Medical Director of the International Harvester Company, Associate Professor of Medicine, Northwestern University Medical School, Chicago.

DINNER

September 28, 1937

RED LACQUER ROOM—PALMER HOUSE, CHICAGO

7:00 P.M.

Presiding—MR. O. E. MOUNT, American Steel Foundries, Chicago. President of the Board of Governors, Occupational Disease Department, Northwestern University Medical School.

SPEAKERS

Introduction by—IRVING S. CUTTER, M.D., Dean of the Medical School, Northwestern University.

"The Role of the Medical Unit in Industry"

Address by—The Honorable FRANCES PERKINS, Secretary, United States Department of Labor, Washington, D. C.

"Health in Industry"

Industrial Medicine
Reg. U. S. Pat. Off.
The Journal of Traumatic Surgery and Occupational Diseases
Executive and Publication Offices
413 Pleasant Street, Beloit, Wis.
Eastern Offices
110 East 42nd St., New York City
Editorial Offices
540 No. Michigan Ave., Chicago, Ill.

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VOLUME 6 SEPTEMBER, 1937 NUMBER 9

Discovery!

INTERESTING it is to observe how often the field of industrial medicine, particularly with reference to occupational diseases, is being discovered. Not that it presents fresh phases with each fresh discovery, but rather that its existence as a field of vital and permanent importance in the life of the world is continually being perceived for the first time by new groups, and in new places.

The events of all these discoveries pursue a pattern. The individual interest grows by contacts; more and more it becomes a group interest; and soon a "conference" burgeons on the vine of increasing appreciation.

This, however, is a very desirable, and very valuable sequence, even if, in some groups which should have come upon their discovery sooner, it is a little belated. And even if—as is already the case—the burden of saying again in a new place what they have said so many times before in other places makes inroads upon the time and convenience of the leaders in thought upon the subject.

The more of conferences and symposiums, and the faster they follow each upon the heels of another, and the more widespread the sites of their assemblies, the better for all who work and are paid for it, and all for whom the work is done and who do the paying. The pioneers in the field and the leaders in its fast-moving development are not too seriously bothered by the demand for papers and addresses and discussions on the matters of their own life-time endeavor. Being of the caliber to reach their respective outstanding distinctions, they are also of the quality to respond when the momentum of the need for knowledge of occupational diseases, which is the real basis of the interest, exacts of them the toll of time and effort which is one of the penalties of prominence.

A PERSPECTIVE upon the rather numerous conferences and symposiums of the last few years, discloses a very interesting—and probably more or less sub-conscious because thoroughly normal—progression. Beginning with the *fact* of occupational diseases, the attention moved from analysis of the causes to synthesis of the treatments. This, of course, was the usual methodical approach of the medical man—diagnosis first, and then the remedy.

If the entire problem had possessed no more than *medical* significance, that would have been its full and final disposition.

But the social and economic phases were as significant in many respects as the medical; the very fact that men were permitted, even expected, to work among hazards to their health was in itself the occupational disease of the socio-economic structure.

There were the employer factors, and—because of the inertia with which time respects precedent—the factors of the individual employees. And from these came the laws—the compensation laws of several decades since, and the occupational disease laws of recent months.

And from these—from the employer side because of reluctance to do what he ought until he must, and from the employee side for reasons of the kind all too obvious in the late "silicosis racket"—are coming the influences which "may result in perverting compensation for occupational diseases into a broad system of health insurance for workers at their employer's expense."

But from the conferences, the symposiums—in the next and current step of their progression—is coming the answer. It is prevention—prevention not only of occupational diseases, but of their causes—heading them off where they haven't been, and making sure that they don't return where they have.

For prevention is the ultimate solution. And education is its handmaiden.

And so more power to the new discoverers of the old field! They are becoming educated. And to their meetings and their discussions. Such are the means of education.

It is good, therefore, to have conferences, good to attend them, good to participate in them, and good to go from one of them to another. He learns at one who may be called upon to teach at the next; he listens today who may be chosen to speak tomorrow.

The medicine of occupational diseases is pretty well set forth in the literature. Conference papers will review the literature, and add to it. And then, increasingly upon its present good beginning, there will grow the literature of the prevention of occupational diseases. May it, from its industrial genesis, become the strong backbone of the literature of preventive medicine.

More power, then, to the medical minds in meeting. For without the prevention, in terms of which they are learning to treat their subject, the laws pertaining to occupational diseases wind soft silk of politics around cocoons of chaos.

Occupational Diseases and Industrial Surgery

Occupational Psychiatry and Neurology

IN CONSIDERING occupational diseases of a chemical nature which involve the central nervous system, survey of the literature seems to indicate that very little has been done to obtain data which can be considered reliable, and the physiological and pathological reaction of the industrial chemicals on the nervous tissue has not been determined.* Of equal, if not of more importance, is the psychogenic effect on certain personality types who work at more or less reputably hazardous occupations. The occupational neuroses play a very dominant role in the disabling of employees, the prevention and treatment of which require special technique. We are at no time considering cases of malingering for the purpose of monetary gain, since careful observation and examination can usually determine the presence of any true pathology, either psychic or organic.

Since all workers in a given environment working under the same conditions do not suffer from the same pathological conditions, it is reasonable to state some people are probably more susceptible to toxic effects of certain chemicals than others. As there is in all probability a physical susceptibility, there may be also a psychic susceptibility which is fertile soil for the development of an occupational neurosis. A highly suggestible, unstable personality combined with ignorance, placed in a position which offers hazards of only the slightest nature will almost invariably develop a neurosis at the first sign of conflict. Inherent neurotic types of individuals who need a more or less protected environment can often be recognized by a trained person during a short interview. Others may appear to be well adjusted, the neurotic strain appearing only when they are attempting unsuccessfully to adapt themselves to adverse situations, either in the working environment or outside. Thus a man having marital difficulties in the home may develop an occupational neurosis in an attempt to escape unconsciously from his family maladjustment.

Let us pause a moment to discuss the personality types and their reactions. The normal adaptable individual when he discovers that his environment is adverse to his physical health, changes the environment. I can best illustrate this by a case which I saw some time ago. The patient came because of a definite and serious involvement of the central nervous system which showed marked evidence of the possibility of being a brain tumor. On examination it was determined that he was suffering from an encephalitis due to some inorganic substance with which he was working. He improved after some time, attempted to return to his work and had a return of his symptoms. Without further complaint, he decided that he could not continue his trade, so he obtained another position on his own initiative. The patient suffered from no personality difficulty although his symptoms were alarming. After he was satisfied that there was present no brain tumor he handled his own difficulty sensibly, this in spite of the fact that he was living under rather marked economic stress. His attitude towards life was that of an adult and he did not attempt to cling to any physical symptoms unconsciously to seek escape. In fact, my complaint was that he was a little too casual, as it was impossible to get him to return for further examination as soon as he was satisfied that he was recovering. As to the liability of the firm for which he worked, it is not in my province to discuss, yet, undoubtedly I would have stated that he was suffering from a very well-defined occupational disease had the question been brought up. This case merely illustrates how a well-adjusted individual faces difficulty when it arises.

The abnormal personalities find it impossible to face the situation without emotional conflict. The further one delves into the individual personalities, the more it must be recognized that personality types are acquired either very early in childhood or inherited. It is probably true that both factors are intimately concerned. It may easily be true that the ability to react emotionally both in character and strength is inherited, and the manner of reacting to a particular emotion is acquired.

The neurotic personality is that type of personality which has failed to reach an adult status. He is dependent on other people or circumstances to make his adjustments. When forced to make his own decisions under adverse circumstances there is present a fear of failure of making the accepted decision. Working consciously or unconsciously under one of the most powerful, if not the most powerful emotion, he wavers in his decisions and finally escapes into a juvenile or infantile emotional status, where the burden of life is carried by others. He may escape completely with a psychosis in which his fears become rampant or in which he realizes security through dependence on others or with ideas of grandeur and power, dreams which are present in all abnormal personalities, but which do not become evident until the stress of life has become too great or until they are released by suggestion. Suggestibility is an important component of the neurotic, being most acute in the hysterical type.

Invalidism is one type of escape since it excuses the individual from adult activities and presents to him the care and attention of others, relieving him from stress of normal life. A hazardous position gives the inherent neurotic individual a chance for a logical escape and he will accept it when conflict arises in any phase of his life. If he is ignorant of the hazard a chance remark may precipitate the neurosis, or the occurrence of an actual pathological case may cause a hysterical imitation.

The neurotic really feels that he is ill and is indeed incapacitated to as great an extent as a person suffering from the disease entity. He is just as much entitled to compensation or financial relief. These occupational neuroses may be classified according to Davidson as to:

1. *"Fright and Shock Neuroses."* These are due to nervousness or continual fear of working under more or less dangerous situations.

2. *"Suggestion Neurosis."* These conditions follow suggestions unintentionally made by the doctors, nurses or others during the course of examination or in general conversation.

3. *"Neuroses on a Constitutional Basis."* These are put in a separate group in spite of the fact that there is some constitutional tendency present in all people who suffer from a neurosis of any type. However, there is a certain percentage who develop a neurosis on such a very slight provocation that they may be classified separately.

4. *"A Pure Compensation Neurosis"* in which the patient's desire causes a conflict because of the wish for sympathy and an income without continuing work which to him is unpleasant.

5. *"Neurosis as an Escape Mechanism."* In these cases the situation serves as a means of an escape from an unhappy status which is often entirely unrelated to the occupation.

6. *"Simple Occupational Spasm,"* which is mechanical in character, one type of which is familiar to all as "writer's cramp." This condition is distinct from malingering and it will be noticed that there people are incapacitated at all times even when they feel that they are alone. It often happens that symptoms disappear after legal settlement, this being based on the fact that one portion of the conflict is removed. For this reason, it is always advisable after a diagnosis has been made not

* M. A. TARUMIANZ, Superintendent, Delaware State Hospital; read before the Medical Department of the Du Pont Company, Wilmington, May 4, 1937; and published in *Delaware State M. J.*, July, 1937.

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to continue payments on a weekly or monthly basis but to make the award in a single sum. Those which are caused by a desire to escape from some conflict unrelated with the occupation are cured with difficulty. Those which are caused by suggestion react quite readily to treatment. Treatment consists in a thorough examination without undue haste, since the neurotic individual quickly senses when the examination is not complete and his physical complaints become more firmly fixed. The physician must be sincerely interested and he must never intimate to the patient that his symptoms are not real and worthy of time and attention. He should carefully explain the nervous basis of the symptoms. Needless to say, all physical pathology should be corrected. Any outside discord should be removed whenever possible. Psychotherapy should be introduced immediately, all forms of suggestion being used. Small personal problems should be adjusted and the patient's symptoms should be explained to him carefully. He should be re-educated to face the problems of life and taught to adopt an adult attitude and learn to depend upon himself. To accuse him of malingering is not only unfair but will fix the symptoms.

Having discussed the type of individuals as well as their reactions, I will continue by describing the neurological and mental symptoms of a few industrial poisons, at the same time leaving the description of the chemicals and their uses in industry to others on the program who are very much better qualified, since I will confess that my experience is limited.

All of the heavy metals are very poisonous, but only lead, mercury, thallium and manganese are of practical importance as the cause of nrevous symptoms, at least as regards our present knowledge. Why these are more dangerous is not determined. Their solubility in lipoids and fatty acids is probably important. Of the chemicals producing polyneuritis, lead and arsenic may be grouped together since this condition results, at least in the general mind, quite frequently. The wrist drop in lead is known by all medical students, although statistics have proved that it is not as common as supposed.

Acute lead poisoning is rare. The picture of the condition may present a meningoencephalitis with a perivascular collection of cells, microscopical hemorrhage, hyperplasia of the vascular endothelium and areas of degeneration. Symptomatically, there is present a disturbance of consciousness, with convulsions. In some cases, retarded action may occur with gait disturbances. This accident is seen rarely and is the result of the consumption of large doses.

Lead, like most heavy metals, is a cumulative poison. (The sulphates, sulphides and iodides of lead are the least important.) The storage of lead in the body follows the same course as calcium, and it has a marked affinity for the bones where it can be demonstrated roentgenologically. It is eliminated through the kidneys, bowels and liver. In the last few years it has been thought that lead is the cause of some of the obscure symptoms found in children. In a section of Australia the frequency of the condition was found to be due to a certain type of outside paint which was being used. Climatic conditions play a role in its frequency, since the drying and chippng of paints may result in a certain amount of inhalation. In ancient Grecian times it has been determined that the condition was possibly due to the use of lead cooking utensils. It is entirely possible that these people suffering from lead poisoning may have been close to the tolerance point before starting in the industry or may be receiving additional doses of the toxic substance from their life outside of the industry. Because of the vaguenesss of the symptoms and due to the fact there seems to again be a slight increase in the number of cases, it is important that the condition should be looked for in all undiagnosed neurological, and internal conditions. The frequency with which lead is found in abnormal amounts in multiple sclerosis is arousing interest in the medical profession at this time.

Although lead neuritis has been considered as the classical symptom it is, as a matter of fact, quite rare and not seen frequently at the present date and is of debatable diagnostic value. When it does occur the extensor muscles, innervated by the radialus nerve are earlier and more frequently involved. It seems to be purely a motor lesion, but there is some question as to the location of the pathology—whether it is in the anterior horns, the peripheral nerves, the muscle tissue, or whether it is due to vascular change. Other irregular types of paralysis may occur, at times being caused by encephalitis. The classic signs of blue line in the gums and basophilic stippling are not constant to lead, being found in intoxication by bismuth and others. Basophilic stippling cannot be considered as of pathognomonic importance unless there are over 250 stippled cells to 1,000,000, while 1,000 stippled cells indicates poisoning definitely. The presence of lead in the urine, blood and other body fluids is *not* diagnostic, as there is a certain amount present in nearly all people due to almost daily contact, unless it is present in large quantities.

The most serious condition which occurs in the sub-acute and chronic types is that of an encephalopathy which gives the symptoms of encephalitis. It is possibly vascular in character but no definite pathology has been discovered. Some authorities believe that the metal tends to cause arteriosclerosis. The symptoms start with headache, insomnia, tremors, dizziness, poor memory and lethargy. Convulsive seizures may be prominent, and a lead epilepsy may occur. There may be present such a variety of symptoms, as lead amaurosis, temporary paralysis, hemianopsias, aphasia, apraxias and sensibility disturbances. Following any of this variety of symptoms a psychosis may occur which is extremely varied in character, resembling arteriosclerotic insanity, mania, clouded epileptic states, catatonic dementia praecox, or even general paresis. (Some authorities think that the Wassermann may be positive in cases of lead intoxicants.) There may be present muscular excitation with vivid, usually visionary hallucinations. The condition may improve or progress to a chronic state with mental deterioration. Lesions in the nuclear areas or neuritis process may involve the eyes, larynx and the tongue.

Lead produces one of the most difficult industrial problems and for this reason the literature abounds in articles regarding the subject. It is a metal with which people are in constant contact. There are no definite diagnostic symptoms which are pa hognomonic for lead intoxication. The laboratory gives us no help except in the quantitative analysis of the body fluids and examination of the blood. Since what may be considered the normal amount of lead varies in different individuals, many cases of neurasthenia may be diagnosed as lead poisoning.

I do not know whether complete laboratory and neurological examinations are made on employees before they start working in lead or not, but this work has probably been done. The treatment consits of two steps: a period of fixation in the bone during the acute stages; and a period of discharge as the patient becomes symptomless.

The first step consists of feeding a high calcium diet, the giving of calcium lactate by mouth and calcium gluconate in a hypotonic glucose solution intravenously. Magnesium sulphate taken frequently will relieve colic. For the second step, the period of elimination, potassium iodide is given in combination with an acid diet. Some authorities give parthyroid extract, increasing the dose gradually from 20 to 60 units. Sodium thio sulphate has been used intravenously in five-grain doses, increased gradually to 28-grain. Where paralysis occurs massage and passive movement is important to prevent atrophy of the muscles.

In the *chronic mercurial poisonin,* there seems to be present a constitutional hypersensitiveness. The cases are seldom seen today, although formerly chronic poisoning was quite frequent. It, at times, occurs in medicine as the result of anti-syphi-

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litic treatment. It seems to attack all body tissues and forms a combination with neucleins.

Symptomatically, following a period of pallor, anemia, diarrhea and kidney symptoms, there is a complaint of headache, poor sleep, irritableness and anxiety. More rarely there may be a mercurial extensor muscular weakness. There is a tendency towards cerebellar involvement, with a typical gait and writing disturbances. Tremors of a paralysis agitans type may be present, with coarse contractions and jerks often accompanied by fine tremors. Mental derangement and erethism may occur. M. A. Kozakevich investigated 133 workers in a mercurial plant in Moscow. He found an enlarged thyroid in 57.3%, with characteristic complaints of thyrotoxicosis. The onset was that of a vasomotor neurosis which gradually developed into hyperthyroidism. Salts of iodine and bromine were recommended therapeutically because of the readiness with which they combined with mercury.

Thallium, which does not seem to be as common a poison as the barium salts, evinces itself by a polyneuritis, with muscular and articular pain and with some cerebral symptoms.

Manganese is an important industrial poisoning because of the hopelessness of the prognosis. It seems to have a predilection for the central nervous system with pyramidal signs. Thalamic symptoms may occur as well as changes in the brain stem,

The Industrial Doctor
OFFICIAL SECTION OF THE NEW YORK STATE SOCIETY OF INDUSTRIAL MEDICINE

Published under supervision of the Ways and Means Committee of the New York State Society of Industrial Medicine. Editorial office, F. E. Redmond, Managing Editor, 406 Root Building, Buffalo, N. Y. Articles appearing herein do not necessarily reflect the opinion or policy of this journal nor of the New York State Society of Industrial Medicine.

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particularly in the area of the lenticular nucleus.

The initial sign is often a disturbance of potency, which is probably due to a cord lesion. The initial symptoms start after a long period of contact. There is present a general debility with languor, pain in the back and numbness of the feet. There appears a tremor of the head, tongue and hands with a later disturbance of locomotion with a characteristic uncertain stamping gait in which "the patient hurries after his own steps to avoid falling, finds difficulty in stopping and avoiding obstacles." The tremors are characteristic of those found in paralysis agitans. The voice is low, whispering and flat with indistinct scanning. Forced laughter and weeping occur without emotional accompaniment and there is an eventual lowering of intelligence. The condition does not react to treatment but may become stationary with the absence of exposure.

In the chemicals described it is noted that the toxic symptoms are predominately an involvement of the motor components of the central nervous system with, at times, a diffuse encephalitis. The symptoms are slow to develop and the elimination is slow with a tendency for the symptoms to persist for a long period of time. Intoxicating symptoms involving the higher centers are not frequently found. Continued exposure is necessary, and careful observation of the employees should eliminate a great percentage of poisonings.

Of the more intoxicating chemicals the cerebral symptoms predominate, while the motor symptoms are secondary. The onset occurs after only short exposure to a toxic substance, and the elimination is rapid, with a rapid digression of symptoms on removal from the agent. Some of them have shown a tendency to be habit-forming, particularly in the case of trichlorethelyne. Here there occurs a singing in the ear with dullness of vision and hearing, accompanied by an inability to move, although consciousness may remain. Euphoria is present, which is followed by a desire to sleep, of a pleasant nature. Unconsciousness and death may occur. Characteristic of the condition is a tendency towards anesthesia of all parts supplied by the trigeminal nerve. Inhaling of benzene and to a lesser extent toluene is characterized by hysteria and excitement, with headaches and giddiness, and with a feeling of being intoxicated and similar signs. There may be present a memory defect following the occasion.

Benzol, as well as toluol, xylene, and naphtha produce pictures resembling alcoholic intoxication. Of these, *benzol* is the most important and the accidents due to it most frequently seen. The symptoms in the acute, mild cases consist of headache, giddiness, gastro - intestinal disturbances, weakness, mental dullness, ir-

ritability or euphoria. There may be an apprehension of death; visual disturbances may occur. As the condition becomes more serious tremors may be present, convulsions and coma may result. The tremors may be muscular in character, described as shivering, or there may be trembling with clonic and tonic spasms. In the most severe cases there may be hallucinations or delirium, or, eventually, prolonged unconsciousness. Neurologically, various forms of neuritis and lesions affecting the dorsal column and the pyramidal tract may occur, causing paresthesias, anesthesias, impaired locomotion and trophic disturbances. The symptoms of this poison are so acute that it has been attempted to substitute with others of the group which are less toxic.

Nitro-benzine has been known to produce a hemi-anesthesia with small circumscribed hyperasthetic areas; these symptoms appear to be of a hysterical nature, as it is difficult to explain them. The nerve trunks become sensitive and there is muscular tenderness which seems to be more prominent in the upper extremity. The fingers have been described as numb and the hands feel as if they were gloved. On walking, the patient may complain that he feels as if he were walking on sand or snow. There is at times concentric contraction of the fields of vision with a mild blurring of the edges of the disc. This symptom varies with the seriousness of the disease process. It is a narcotic but also, and frequently, produces convulsions. In the chronic poisoning, peripheral neuritis may occur. *Benzine* and *naphtha* are intoxicating chemicals, inhalation of which produces excitation, hysteria, headache and the feeling of being "drunk." There is often a heavy sleep of the type found in alcoholic intoxication.

Methyl alcohol is extremely poisonous and has a cumulative effect. Schwartzman describes a case of an engineer who after working in a plant for three months developed a condition of excitment, double vision, nystagmus, ataxia and anamolous reflexes. On being removed from the plant he became symptomless but on returning to work developed a paralysis of the facialis and abducens nerve and a decrease in vision. Methyl alcohol is destroyed in the system only with difficulty. In the cases of acute poisoning there are abdominal pains accompanied by general weakness, nausea and vomiting, midriasis is present, blindness which is complete and may become permanent, is a fairly frequent symptom. In the chronic cases, there are present hyperesthesia and paresthesia of the hands with pain on pressure over the nerve trunks. There is pain in the joints, which is distinctly noted on moving the head. Symptoms of a peripheral neuritis occur. Complete blindness follows in a few days, in

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which the pupils are dilated and sluggish but may or may not react to light and convergence. Occasionally a temporarily paralysis of the extra-ocular muscles is noted.

Petroleum is acute in its action, produces a feeling of exhilaration, followed by a feeling of heaviness with vertigo and loss of consciousness as in an anaesthetic sleep. At times there is definte inebriation with shouting and reeling. There is loss of memory for the occurrence. Pupils are contracted. The treatment is one of symptomatic stimulation and strong hot tea.

Pyridine has been known to give definite mental symptoms resembling an encephalitis. There has been present a loss of consciousness, facial nerve paralysis, attacks of screaming, nystagmus and inequality of pupils and disturbance of gait. Recovery occurred after removal from the agent.

Arsenic does not have a predilection for the nervous system. However, there may be present a peripheral neuritis, with a possibility of loss of function. The lower extremities are involved more frequently than the upper. It is often multiple in charactre but rarely involves the trunk. There is at first a paralysis of sensation followed by a motor paralysis. The condition is usually symmetrical and shows a predilection for the extensors of the foot. In the final stages of arsenical poisoning there may be mental apathy, but the cerebral symptoms are not important. It closely resembles lead poisoning in some aspects, but differs from it by the absence of the blue line of the gums and absence of constipation, involvement of the flexor muscles at times, and the fact that the lower extremities are more generally and frequently involved. The elimination is hastened by potassium iodide. Severe cases of neuritis may require analgesics; later, massage and electrical treatments are necessary to prevent atrophy.

Aniline does not have any predilection for the central nervous system, but there may be present slight insomnia, headache and dizziness. There is at times a loss of memory. Its symptoms are that of an intoxicant and the patient shows loquacity with slow labored speech. He may have a reeling, unsteady gait. In the more chronic cases there is general debility with loss of sleep and disturbances of sensibility and motility and spasmodic muscular pains.

Carbon disulphide, used in the making of artificial silk, seems to have a definite predilection for the central nervous system. The symptoms which it gives are varied and both the brain and spinal cord are involved. There may be symptoms which definitely resemble paralysis agitans, or a peripheral neuritis may result. The symptoms are rapid in onset and frequently difficult to differentiate from hysteria. The acute symptoms are those of marked stupefication, the feeling of intoxication with flaccidity of the extremities. There is an obliteration of all the reflexes and an eventual loss of consciousness due to paralysis of the central nervous system.

The chronic forms show headache and pain in the extremities. There may also be present spasms or fibrillary twitchings. Transient and permanent paralysis may occur, with atrophy. Itching and formication are present, and there is a reduction of the reflexes. There are present areas of anaesthesia and analgaesia. Disturbances of vision are common, sometimes transitory in state. Retrobulbar neuritis, choroiditis and central scotoma have been described. Cerebral involvement is marked. There may be present a condition of excitement followed by one of depression. The patient may be irritable and even violent and evince an explosive temper. Early there is hyperstimulation of the sexual instinct followed by an abnormal decline. If the person continues in the atmosphere after several weeks or months of preliminary symptoms, there develops a psychosis characterized often by melancholy, a dreamy manner,

THE BULLETIN of The American Association of Industrial Physicians and Surgeons

THE object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for the mutual advancement in the practice of their profession.

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and weakness of memory. The mental disease may stimulate either an acute mania or dementia praecox. The prognosis for recovery is good. These severe types of intoxication occur in only such individuals who have a predilection for the intoxicant.

Carbon monoxide has in some instance shown a predilection for the central nervous system with an eventual feebleness of the psychic functions. There has been described a reduction of visual acuity and sexual potency.

Carbon dioxide produces excitement, followed by loss of consciousness and by inability to move.

Although any chemical may produce secondary effects on the central nervous system, even as any infection may, the majority of them as stated before do not have a special predilection for it. All of the esters have a paralyzing effect on the central nervous system, giving approximately the same picture. Lead, carbon disulphide, benzol, are the chemicals which show a comparatively high percentage of cerebral involvement, resembling many other types of psychoses. Yet psychoses occurring in a plant do not mean that the chemical always is at fault. A case of dementia praecox may occur in a toxic atmosphere as well as it can in any other environment. The disease would have occurred no matter where the individual was located and the industry cannot be blamed. It is true that worry over a more or less hazardous position may precipitate a psychosis which has been latent for many years, but it would be radically unfair to hold the industry responsible for the production of the condition.

The treatment of all of these conditions involving the central nervous system may be placed in four categories: namely, removal of the individual from the toxic environment; hastening of elimination of the poison; prevention of muscular atrophy where paralysis is present; and psychotherapy where the condition is of a neurotic type. Preventive work from a psychiatric viewpoint is of the greatest importance. No individual should be employed in a hazardous industry who is not in excellent physical condition, as in such a case there is only an added strain. The plant physicians should be qualified to carry on a detailed neurological examination. This is of great importance at the present time because of the frequency in which abnormal neurological symptoms are found possibly due to mild types of encephalitis or to hereditosyphilitic states in which the Wassermann may remain regative. Routine lead analysis of those working in lead plants before commencing their work might often save difficutly from a diagnostic viewpoint later.

Individuals working under such hazardous conditions should not be employed by means of recommendation alone. Personal interview, fairly prolonged should be carried out by an individual who has some ability to recognize personality types, so that irregularities can be noted. The plant physician should be so familiar with his employees that he can recognize suble emotional changes, slight differences in gait or a difficulty in musclar movements. When the physician is able to recognize these on walking through the plant, carefully observing the employees, he will be able to prevent chronic disturbances by early removal of the worker from the atmosphere. Individuals, showing evidence of emotional disturbances, should be removed from the hazardous position until their problems have been adjusted, to avoid their grasping at occupation as a means of escape.

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Health Supervision of Youthful Workers

HEALTH supervision of employees under 18 years of age has been instituted in industrial and commercial establishments by the Labor Medical Service.* This supervision consists chiefly of medical examinations undertaken according to the following routine: (1) an examination of each worker during the first month of employment, (2) a general annual check up and (3) special follow ups of young workers whose state of health has been judged precarious on previous examination. These follow ups may be semiannual, quarterly or monthly according to the decision of the medical inspector.

Employers are compelled to cooperate with the medical officers in order that the health supervision may function as smoothly as possible. The principal duties of employers in this connection are: (1) Maintenance of an up-to-date list, in conformity with the model prescribed by the health service, of all employees under the age of 18. This list may be requisitioned at any time by the regular medical inspectors or their superiors. (2) Notification of the medical inspector within two weeks following the employment of any person less than 18 years of age. (3) Reporting to the medical inspector the frequent absence on account of illness or the chronic ill health of any young employee. (4) Provision of the examining medical officers at the time of their visits with quarters that are suitably lighted, ventilated, heated during cold weather and equipped in a way that will assure the swift and decent conduct of the examinations. (5) Full compensation of the employee for time lost from work on account of medical inspections. (6) Compliance with the recommendations of the medical officer in the matter of the type of work assigned to the individual abdolescent employee. This will safeguard the physical development of youths known to be in delicate health. (7) Communication to the Labor Medical Service of all information requested by it with regard to decisions in particular cases.

The medical examinations mentioned under article 1 take place at the expense of the employers and are carried on by physicians selected by the employers and approved by the minister of labor and the Prevoyance Social. Examination will take place either at the doctor's office or in suitable quarters on the firm's premises placed at the doctor's disposal.

The results of these medical examinations shall be entered in the "carnets sanitaires" (individual pocket health cards) of the employees in question. A "carnet sanitaire" is made out by the employer following the initial medical examination of any employee who does not already possess such a card.

* Belgium correspondent, *J.A.M.A.*, July 17, 1937.

The Problem of Medical Care

THE American Foundation has made public, in a comprehensive report, the views of leading doctors and surgeons throughout the country on the present status of American medicine and on the problem of making "adequate" medical care available to the large part of the population that now fails to get it.

The report—which appears under the title, "American Medicine: Expert Testimony Out of Court"—sum-

marizes the results of an inquiry to medical men begun by The American Foundation nearly two years ago. The doctors—chiefly those who have been in practice 20 years or more—were asked whether they feel that radical change in the present system of medical care is indicated, and, if so, in what directions. There was no questionnaire; the doctors were invited to comment freely upon all relevant points, and they did.

The report makes no recommendations; but in quotations from thousands of singularly sincere and spontaneous statements it analyzes profoundly and without reserve the *whole* structure of American medicine, presenting the whole picture—including, as one doctor puts it, the back of the house as well as the front.

Is Adequate Medical Care Now Generally Available?—Since there is no general agreement as to what is "adequate" medical care and what is meant by "available", many agree that there is no categorical answer to this question. But if medical care is interpreted to mean the kind of care needed to enable citizens to maintain "positive" health, preventing incipient illness from progressing to serious consquences, as well as doing all that can be done to restore the sick individual to health, the weight of opinion is certainly that adequate medical care is not available. Even if adequate medical care is less ambitiously defined, this section contains a good deal of evidence in the form not of statistics but of direct picture (by men on the scene) to justify the premise that a large part of the population does not receive adequate medical care:

(a) Because it costs too much, especially hospital service and the laboratory aids to diagnosis;

(b) Because it is too far away—as in the vast agricultural areas far removed from medical centres and without either hospitals or practitioners;

(c) Because the public generally does not understand and is not asking for modern scientific medical care, much of the population definitely preferring quacks, cultists and patent medicines; and, finally and most important,

(d) Because in the medical care of the present "the best is not yet good enough", to cite one of many spokesmen.

The reasons why medical care is not yet good enough are many but these are the reasons most frequently brought forward by the physicians:

(a) There is a lag of years in applying new medical knowledge;

(b) Present medical training is not yet uniformly good;

(c) Present licensing is too broad;

(d) Too many graduates do not or cannot *keep up* their competence;

(e) Medical imagination still does not sufficiently perceive that prevention rather than cure is the real

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and ultimate goal of medical science, as many competent leaders of medical science in this discussion declare it to be.

The Art of Pogonotomy—or How To Shave Most Satisfactorily!

SATISFACTORY shaving in normal health may be specified as that in which there is an optimum combination of freedom from discomfort, little effort for close shaving and minimum damage to the skin.* Our discussion shows that blade sharpness and razor design are inextricably interwoven; they cannot be specified in definite terms because of the wide variation in individual tastes and requirements. Generally speaking, men to whom discomfort of shaving is an important item will require a smaller effective shaving angle and sharper blades than will men having insensitive skins. The same is true in the case of men having particularly thin horny layers of epidermis.

In providing satisfactory shaving for himself the individual can go a long way by means of adequate facial preparation. The best procedure found by us is as follows:

Wash the face first with soap and water, using hot water and some toilet soap that has been found not to irritate the skin. Carry on this operation for about one-half minute and then rinse the face thoroughly. The purpose of this washing is to remove the grit from the face, which might damage the blade, and to remove the external layer of sweat and sebum from the skin and hair, as well as other extraneous material. After the soap has been thoroughly rinsed off with hot water, a second layer of soap should be applied. This may be one's favorite shaving soap. It is to be thoroughly rubbed into the surface of the skin with the hand, copious amounts of water being used. These two operations should be made to consume from two and one-half to three minutes.

If latherless cream is preferred for shaving, it should be applied on top of the soap and should be rubbed around enough to mix thoroughly with the lather. If lather-forming soap is to be used, it should be whipped into a lather with a shaving brush. When this lathering is completed, no harm will be done by extending the time the face is in contact with the soap by finding other things to do at this time, such as brushing the teeth or reloading the razor.

Shaving should be begun by wetting the razor with hot water and keeping the face well lathered; both the razor and the face should be kept wet during the entire operation. It is good practice to shave the less difficult portions of the face first, in order that the more difficult portions shall have the benefit of a still longer contact with water. Following shaving the preferred lotion or other post-shaving preparation can be used after the soap has all been rinsed thoroughly from the face.

Mechanical and chemical traumas associated with the operations of shaving produce in certain men an abnormal feeling, a hypersensitivity of the face. Good shaving practice includes in its purposes the minimizing of this feeling. For the hypersensitive person we propose the adoption of one of the following changes in the preparational operations: (1) the use of cold water for the final lathering procedure, following the hot water preparational period, or (2) the use of menthol incorporated with the shaving soap or cream.

* From an article "Factors Involved in Satisfactory Shaving,"—a summary of the results of four years of investigation on the subject of shaving conducted at Mellon Institute — by LESTER HOLLANDER, M.D., Chief, Dermatological Service, Pittsburgh City Hospital; Chief, Dermatological Service, Montefiore Hospital; Medical Director, Pittsburgh Skin and Cancer Foundation, and ELBRIDGE J. CASSELMAN, S.B., Industrial Fellow, Mellon Institute, University of Pittsburgh; published in *J.A.M.A.*, July 10, 1937.

Some Facts on Compensation Costs With Special Reference to Inclusion of Occupational Diseases

IT IS common for speakers on the subject of safety and accident prevention to stress the fact that the cost of Workmen's Compensation for accidents is largely what the employer himself makes it.* It is said that by careful attention to management and the promotion of safety consciousness, the employer's cost is minimized, while, on the other hand, carelessness and lack of training greatly contribute to such cost. This is all true. In saying that, however, we touch not at all upon other factors that are in the situation, and that require equally our thoughtful consideration.

When we reflect upon the enormous increase in the cost of compensation from its early days, the year by year piling up of that huge burden, we may wonder what has been the cause of it all, of what use has been all the safety engineering work of these many years,—has it been worth while? Surely it has been worth while. The profession of the safety engineer has been one of the great benefits to the worker in these days of speed, rush and mechanized industry. Indeed I venture the thought that the very existence, and development of industry these past two decades would not have been possible except through the efforts and intelligent guidance of those who have devoted themselves to the control and elimination of accidents. If industry today, with its mass production, its utilization of tremendous power, its speed, its lowering of production costs by the use of involved machinery, were still to adhere to the safety principles and practices of 1915 it is questionable if the loss of life, the maiming, the human wreckage, would not be so great as to prevent all forward movement of industry and to change the whole economic and social structure of the times. We could not exist as an industrial nation except for the recognition and practice of the safety principles and intelligent application of accident prevention methods.

That the cost of compensation, from its moderate beginnings, has enormously increased is too well known to require statistical elucidation. If, as we know, the work of the safety engineer and the plant manager has been effective in accident prevention, to what must we attribute this increase in cost? Popularly such increase is ascribed too much to the successive and progressive increases in the scales of benefits enacted by legislatures. This is only a part, though an important part, of the story. Probably more important are the progressive liberalizations in the administration of the laws—and the enlargement accordingly of the conditions giving the right to compensation.

In effecting these liberalizations, the courts and commissions have vied with the legislatures.

In framing compensation laws, we thought that we knew what the term "accident" meant We visualized the accident of force, when the damage to bodily structures was evident. In our mind's eye we saw men fall from heights, we saw ladders and scaffolds break, we saw hands or feet caught in machinery, struck by flying missiles or falling objects. Did we regard as accidents such misfortunes as chronic rheumatism or arthritis, hernias, tuberculosis or heart disease or other diseases preexisting and merely "lit up" or aggravated by normal incidents of work? We did not; but we were evidently mistaken. Now the cost of compensation for such so-called injuries is a huge addition to the cost of compensating for old-fashioned accidents.

The requirements that there must be an "accident" and that it must "arise out of and in the course of the employment", that prompt notice must be given and prompt claim made, and the requirements as to many other matters of proof, have all been and are being liberalized and extended by statute and construction. This is done to such a degree as to admit a flood of impositions and abuses that magnify the cost far above original expectations or what logical principles would demand.

Moreover, we started off with the belief that the employer's liability for compensation, like other legal liabilities, would become fixed and settled within a reasonable time after an accident, presumptively at the end

* HENRY D. SAYER, Manager, Casualty Department, Association of Casualty and Surety Executives; An Address delivered before the Congress of the Greater New York Safety Council, at the Hotel Astor, New York City, April 14, 1937.

of the healing period Now, however, it is becoming a frequent rule that workmen may come back even years later and be awarded additional compensation, retroactively, for long forgotten injuries, or for injuries for which full settlements already have been made

It was the doctrine of workmen's compensation, as first advocated that, the employer's liability being absolute "regardless of fault", the compensation should always be less than full damages—that it should amount only to a major portion of the actual wage loss or loss of earning capacity. That doctrine has steadily been discarded. Compensation is now reaching far over into the fields of general health, old-age, life and unemployment insurance. It begins to take on the aspects of social security, wholly at the expense of the employer, although we know that in many cases, the fault of the injured person stands out like a sore thumb.

An illustration in point is the cost of medical benefits. In New York, for instance, while the law has been broadened in important particulars, we find none the less that the cost of medical benefits over a ten year period has increased by more than 300%. The cost of medical alone at the present time is well over ten million dollars. This tendency has been marked elsewhere. In Massachusetts, the cost increased in even greater proportion,—the figures showing an increase between 1915 and 1930 of 450%. While there was some drop in these costs during the depression years because fewer men were at work and there were, therefore, fewer accidents, there is every reason to assume that this item of cost will continue its earlier trend. Indeed some preliminary figures in New York, under the new medical provisions, seem to indicate a new and very rapid upward trend.

It is not my purpose here to discuss all of the factors that contribute to these great increases. Some are statutory. Some originate in administration. Some are due to the improved economic status of the workers. The point is that all this increasing burden is a definite part of the overhead cost of production. It is a fixed charge upon industry much as taxes are. Industry must pay this cost, and industry must collect this cost in its price scale. Over a period of years compensation can be paid only out of income; it cannot long continue to be paid out of capital or out of surplus. Therefore, it has a very real relationship to prices and to income, and quite naturally must be a factor in competition. It is a fact of the business with which management must concern itself. We know by experience that the general level of cost never drops. While the cost to a particular risk may be reduced by careful attention and engineering control, industry as a whole must look to the general cost level.

STILL another cost factor is coming to have an important place in the burden of compensation. What has been said heretofore relates to accident compensation cost. In much the same way the same or similar factors may be expected to affect the cost of occupational disease compensation. That cost generally is not inconsiderable; in some particular classes of industry it is very heavy. Increased costs in that field may be expected. Let us then consider the occupational disease phase of compensation costs.

When the question of compensation for occupational diseases first arose in this country, it was contended that the cost thereof would not add one per cent to the cost of compensating for accidental injuries Even today some contend that in the state of Wisconsin, where there has been a considerable experience with occupational disease coverage, the over-all cost of such diseases in compensation is only a little over two per cent of the cost of accident compensation. Such contentions are not based on the actual facts. For the purpose of presenting such a good face, they spread the occupational disease cost over all of industry, regardless of whether such cost belongs on all industry. Thus an hypothetical cost level is reached and it is far from the real cost to the industries specifically affected. If, as it should be, the cost be allocated only on such industries in which there is exposure to such diseases, and be estimated on the payroll of only such workmen as are exposed, an entirely different story is revealed. Thus, in Wisconsin, the cost of compensation in steel foundries rose from $2.58 per $100 of payroll on policies issued in 1929 to $22.13 on policies issued in 1932, the increase being attributable almost entirely to silicosis. Such a cost was exceptional. It was due in part to an outbreak of claims from men being laid off because of the depression, and it included a mass of so-called "accrued liabilities". However, it illustrates the fallacy of "average cost"—and it emphasizes a difficulty in the way of making a reasonable pre-estimate of the cost for any given policy year for such a disease as silicosis.

The "classic" occupational diseases —that is, those enumerated in the older schedules and upon which considerable experience has been developed, present no serious cost problems.

Lead poisoning, the most common and most serious of these classic diseases, was estimated for the policy year 1933 to entail a cost (in five States and the District of Columbia) of 5.7% of payrolls in the occupations in which it is prevalent—much more in those particular establishments or employments in which the hazards were exceptionally high, and correspondingly less in others. This item of cost, however, seems to be yielding to preventive measures, and to the inducement of premium rates which are proportionate to the hazards.

The cost of dermatitis seems to be mounting inordinately in Ohio, where it is spread evenly and indiscriminately, over all subscribers to the State Fund. But with an incentive to employers to prevent exposure by such employees as have demonstrated a special susceptibility to the disease, the cost of compensating for it can be kept within reasonable bounds.

There is a special difficulty with new occupational diseases resulting from new industrial processes. This is illustrated by New Jersey's experience with radium poisoning. Some years ago in that State, a company employed young women to paint watch and clock dials with radium paint. A number of these workers wet their paint brushes on their lips. For three or four years no one suspected or had cause to suspect any danger. Then the employer had a scientific investigation made. It revealed the danger, and the employer took all precautions. Later the ill effects from the old exposures developed, and the employer was deluged with suits for damages—some of which were bona fide while others were highly speculative. Many of these suits were settled, and in some, substantial judgments were recovered by the plaintiffs.

The orderly remedy for the detection and prevention of such new hazards is for a Bureau of Hygiene under state health authorities, or possibly under labor departments, to keep track of new processes in industry. Such a Bureau should be alert to advise precautions and preventive measures, and should promptly initiate additions to the schedule of occupational diseases set up in the law.

The great problem as to occupational disease compensation cost relates to compensation for dust diseases of the lungs—generically called pneumoconiosis—of which only silicosis and asbestosis are now recognized to be really occupational. These diseases have peculiar features among them: slow and insidious contraction, requiring years of exposure; absence of positive symptoms in early stages; a progressive character and a tendency to complication with tuberulosis; difficulty of diagnosis or differentiation from non-occupational conditions. The cost of compensation for them may vary greatly according not only to the scale of benefits fixed in the statute, but also according to the principles to be applied, the criteria of liability, the time limitations, and the competency and impartialitf of the tribunal to decide disputes.

Moreover, at any given time when a law is enacted covering these diseases, it is a fact that men will have been working for years in silica dust-laden air, they will have been exposed for long periods, and they will in many instances have already contracted this lung diseases, although without typical symptoms or immedi-

ate disability. This gives rise to what we commonly refer to as an "accrued liability". By this we mean that the condition which may eventually cause disability or death has already become a fact,—a real and inescapable fact. The condition is not amenable to treatment; it is permanent. It may be controlled to some extent by removal from further exposure, or, it may progress to the next disabling stage without further exposure. Mark well,—during all these years of exposure there was no compensation law on the subject, no legal liability on the employer, and certainly no assumption of any liability by any insurer.

This strange condition gives rise to an unknown and well nigh unknowable cost. As from accident, disability or death arises at a given time in the future; but utterly unlike accidents, the conditions from which such disability or death result, are largely matters of past exposure. In addition, the exposures largely responsible for the condition may have been chiefly in other employments, entirely unrelated to the employer who employs the unfortunate victim at the time of disability or death.

WHOSE is the burden of the accrued liability? Is it the employer's? Only in part. And that part should reasonably represent the exposure in employment after the law has cast a compensation obligation on industry. Is it the insurer's obligation? Certainly not. The insurer's obligation is contractual, and is based upon the payment to all insurers by all of industry of a fund sufficient to measure the anticipated cost. But here there was no contract obligation at the time the disease was acquired, and no payment made by industry for any such purpose. To expect the insurer to pay for past contractions out of future premiums is utterly unsound in principle and dangerous to the interest of all the other persons who have passed over to insurance their contingent obligations in many fields, and who have paid in advance for protection against such future happenings. Their money, paid for insurance against other risks, should not be jeopardized by assumption of losses never contracted for or contemplated in premiums charged for insurance.

Whose liability then is this accrued liability? If during all these years and past generations we have been unsound and unscientific in our legislative approach to the worker in dusty atmosphere, it may be that the worker must assume some considerable portion of the "risk of the trade" himself. In fact, it has repeatedly been said by representatives of labor that they are more concerned with preventive measures as to the future than they are with compensation for what is past.

But another point of view has been expressed many times. It is that the accrued liability is a public liability, and some part at least of the burden should be publicly assumed. This suggestion was voiced at the recent National Conference on Silicosis at Washington, but there was no consensus of opinion as to how or in what proportion the burden should be publicly taken over.

Special difficulties arise in estimating in advance of actual disability the cost of compensation for silicosis or other lung diseases. Certain of these claims will emerge in good times as well as in bad, but the probability is that such claims will be brought to a head when workmen are laid off in a period of depression. Sooner or later, of course, the cost of the accrued liabilities will be added to the growing current cost of losses resulting from exposures under the new law. There are some indications, however, that the accrued cost would equal or possibly exceed seven times the current annual cost.

It is difficult to learn the cost of silicosis even where it has long been compensable, in terms of percentages of payroll of those workmen who are exposed to the hazard. Thus, in Ontario, we know that the reserve—the estimated average cost—for each case of silicosis is $11,500 (including $3,000 for medical benefits); and this cost is directly assessed to the industries affected. But we do not know the cost in percentage of the payrolls of exposed workmen.

Furthermore, we have some data as to percentages of cost on industries in Great Britain, and New South Wales, Australia, as well as the South African experience. So unlike our laws, and so different are their systems, that any deductions drawn from such experience must be viewed with discrimination. So many qualifications must be injected into their cost figures that the issue here tends to be confused.

We know that silicosis is closely associated with pulmonary tuberculosis. Those even slightly affected by silicosis are said to be exceptionally susceptible to tuberculosis, whereas the tubercular are likewise exceptionally susceptible to silicosis. Prevention of silicosis, therefore, seems to call for a rigid exclusion of the tubercular from the dusty industries. But tuberculosis may be active or inactive. Are workmen with inactive tuberculosis to be thrown out of their established occupations? Manifestly, the cost of compensation for silicosis will depend greatly upon the methods adopted in dealing with the tubercular—and the most effective methods—until long established—may entail hardships. Industry cannot assume the burden of relief for such a common, non-occupational disease as tuberculosis.

Here, in particular, is a field for exploration of the public assumption of cost. Tuberculosis is a recognized public health problem. For his own good, the tubercular should be entirely separated from dust exposure; for the welfare of his fellow workers, who have not yet contracted the disease, his removal from their midst is imperative.

But in removing him from the industry, the unfortunate tubercular should not be cast into the industrial scrap heap and forced to go entirely on his own. Surely the funds of government have not always been utilized in as worthy a cause!

To mention another difficulty: Silicosis may be so slowly progressive as not to disable affected workmen appreciably before the normal termination of their working lives. Yet a silicotic workman, retiring in old age, may claim that his ailment forced him to quit a year or so earlier than would otherwise have been necessary. An aged silicotic may die from pneumonia, apoplexy, hardening of the arteries, or some other common illness under circumstances where it may be credible that he would have lived or been able to work a few years longer, if his lungs had not been affected. Under such curcumstances, is the disablement to be charged entirely to silicosis, and, in case of death, are the deceased's dependents, actual or presumed, to be entitled to full death benefits? Unless special provisions are included in the law to bar such consequences, compensation for silicosis may amount to high level old-age and life insurance for nearly all workmen who pass their lives in dusty occupations, and the cost will be incalculable. On this point, experience is peculiarly lacking, since compensation for silicosis has nowhere been in effect through a full working generation—except in South Africa, where labor conditions and compensation practices are too different from ours to serve as a guide

A very complex problem involved is this: It is not proposed to pay compensation for the condition of silicosis, but for *disability* or *death caused by silicosis*. But what is "disability"? Is "partial" disability to be compensable and is a workman to be entitled to the usual compensation for partial disability where he is able to work in a clean occupation but is laid off because it would be unsafe for him to continue in his dusty occupation? How is such partial disability to be determined? Or is only total disability to work in any suitable occupation to be compensable? Obviously these two extremes indicate the possibility of a wide difference in the cost depending upon the standards of compensable disability adopted. If partial disability is to be compensable, together with inability of men in dusty trades to get jobs in periods of depression, compensation for silicosis will carry with it an expensive side line of unemployment insurance. Here the imperative need of an impartial and expert board of physicians to determine medical questions is strongly indicated.

If compensation for silicosis is to

include unlimited medical benefits—i.e. everything that may possibly cure or *relieve* the workmen—which might include experimental medicine and maintenance in a sanatorium—in addition to full compensation, it is probable that the cost would be increased in excess of fifty per cent and most wastefully. The possibilities of exploitation in this field are easily imagined. It is significant in this connection that under the British compensation law, to which we look primarily for cost experience, there are no medical benefits. In Ontario, however, even under conditions of strictest governmental supervision, the average medical cost per case is $3000, and in many cases the cost runs far higher. We could not even hope to keep the medical cost within the bounds of the Ontario experience.

Finally, the most vital factor in keeping down the cost of compensation for silicosis is prevention. Again there are difficulties in the shape of expense. And the elimination of the unfit is a big problem of itself. Moreover, though means for prevention should be emphasized, too much should not be expected from them. Certainly future preventive or dust control devices will not obviate a lung fibrosis already formed. It can only arrest it or retard its further development appreciably. For the generations to come, dust control is the absolute key to the situation. If, twenty years ago, we had known what we know now about silicosis, if we could then have prescribed appropriate regulations for its prevention and made properly safeguarded provisions for the compensation of its victims, I am sure that we would now have comparatively healthy groups of workers in the "dusty trades". We would not now be confronted, as we are, with this difficult problem of an accumulated mass of "accrued liabilities".

PREVENTION, however, is not a matter of dust control alone, or of silicosis. It has a wide significance in a tremendously large field of industrial activity. The safety engineer of the future must be disease prevention-minded, as well as accident prevention-minded. The safety engineer must have his counterpart in the industrial chemist and the industrial hygienist. Ordinarily harmless minerals as well as known poisonous substances are being used in new ways and for newly developed purposes. They may be recognized by the law, but are their uses thoroughly understood and their dangers fully perceived?

Will they be better perceived, better understood, better guarded against, under a law that lists and specifies the diseases and conditions that come under compensation? I think so.

One among many of the very real objections to an all-inclusive coverage for occupational diseases, without specifically naming them all, is the lack of suggestiveness in the law. To mention lead, arsenic, mercury, and benzol, is to put industry and the industrial engineer on their guard as to those particular poisons. And the same applies to all the numerous list of occupational disease hazards.

Another objection to the all-inclusive form of law, is that, in effect, it empowers the industrial commissions and the courts to "enact" what diseases shall be compensable. It permits them to change their minds from time to time, leaving employees and employers uncertain of their rights and liabilities and subjecting employers and their insurers to sudden and erronous extensions of liability. Even-

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DUST IN INDUSTRY — What the hazards are; how to determine their existence; how to combat them.

INDUSTRIAL DUST

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This book covers the problem of dust control in its relation to the health of workmen, emphasizing the cooperative nature of the problem both for physicians and engineers, and presenting principles, methods and data for the design and operation of dust-control equipment. It discusses the physical aspects of dust and fume suspensions and their effect upon man; the analysis, measurement, and microscopy of fine dusts; and the practical control of dusts and use of respiratory protective devices.

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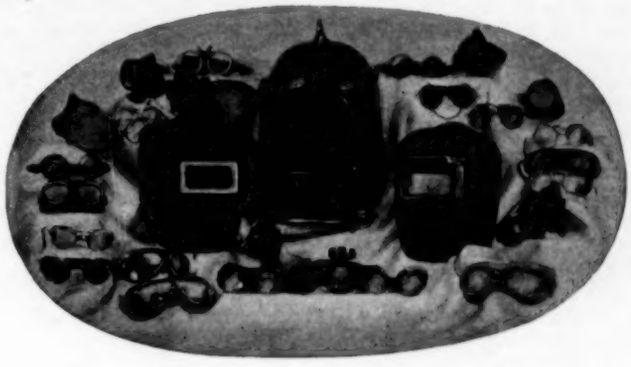
tually such a system may result in perverting compensation for occupational diseases into a broad system of health insurance for workers at their employers' expense. It may be contended that our limited experience does not justify such fears. But it cannot be denied that such a result is inherently possible in such system. To avoid such a result we must depend on a government of men rather than a government of law which is un-American. The history of developments under "all-inclusive coverage" in the laws of Connecticut, Massachusetts, California and Wisconsin is very suggestive of such disastrous possibilities.

In his "History of Workmen's Compensation for Occupational Diseases"*, P. Tecumseh Sherman, gives eloquent testimony on this question in a most authoritative way. In this connection it is significant that, under laws with all-inclusive coverage, awards have recently been made for "flat-feet", bronchitis, pneumonia and arteriosclerosis. Between such ailments as these and a multitude of others that may be aggravated or accelerated by normal incidents to particular employments there is no logical dividing line; and there isn't money enough in industry to compensate for them all at the high levels provided for by accident.

What then shall we say of the present and probable future burden of compensation for all accidents and diseases? How far can the compensation premium dollar be made to stretch? How much loading of this kind can we place on industry and still expect it to survive and prosper and to continue, as in the past, to furnish the means of livelihood to the millions dependent on it? I wonder, too, whether sufficient thought is given to what the compensation system really is. I should naturally expect the wiser councils of labor itself, knowing the benefits, yes the blessings, of the compensation system, to give serious thought to the possibility of a breakdown of the system utterly from a top-heavy overloading.

Compensation laws good on paper but without jobs is but a beating upon sounding brass, all fuss and noise, without real benefit. Industry should, and industry will, assume its full share of responsibility for the ills that follow in its wake as the natural and unavoidable consequence of industry's own processes. But we must be on the alert to guard this system, to stay the hand of those who would make of compensation unintentionally the instrument of industry's own destruction. Progress along these lines, and particularly in the matter of compension for diseases, must be intelligent and reasonable. Intelligently applied compensation will become an even greater agency for the relief of human ills; greedily grasping, however, it will fail and great will be its fall.

* Bulletin of the Association of Casualty and Surety Executives, No. 41, July, 1935.



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Syphilis and Unemployment

A SERIOUS social situation is in process of creation by virtue of the current medical and lay interest in the campaign to control syphilis. *Medical directors of large industrial corporations, and of the Federal government itself are requiring routine blood tests of all applicants for positions, and are refusing employment to those found to have positive serologic tests for syphilis. In some instances, employees have been tested and, if found infected, dismissed.

The reasons assigned for this procedure are three-fold: (1) the danger of transmission of spyhilis to others; (2) the risk that a syphilitic person handling dangerous machinery may endanger the lives of others; and (3) the additional economic risk imposed upon the company by the possibility that the syphilitic individual may become disabled directly or indirectly because of his syphilis, thus imposing, through various forms of industrial compensation or other types of social insurance, the burden of his care upon the company (or Federal government).

As related to the use of the routine blood test as a standard for employment, these arguments are fallacious.

* Editorial in *Am. J. Syph.*, May, 1937; condensed, as here, in *Current Medicine*, June, 1937.

1. The danger of transmission of syphilis through non-sexual contact is slight, even in the case of food handlers, barbers, and "beauticians." Even if the patient has early infectious syphilis, he promptly becomes non-infectious as soon as the diagnosis is made and modern treatment started, and remains non-infectious (in the vast majority of cases) if treatment is prolonged to forty weeks. Whatever small risk of infecting others may exist is for all practical purposes limited to the period *before* the diagnosis is made. The employer's obligation to society, so far as the prevention of spread of spyhilis is concerned, is much better served if he retains the infected person in his employ contingent on immediate and prolonged treatment, than if he dismisses the patient to completely unsupervised treatment or none at all.

If the employee has late syphilis of more than five years' duration, there is no danger whatever of his infecting his co-workers; and refusal to employ or dismissal on such a ground is indefensible.

The blood serologic test is not a criterion of infectiousness. During the seronegative primary stage or during infectious secondary relapse, the test may be negative, though the patient is highly infectious for others; in late syphilis, and though the test is usually positive, the patient is not infectious. The routine positive blood test cannot be used as a guide to infectiousness in industrial medicine.

2. The risk that a syphilitic person handling dangerous machinery may endanger the lives of others is limited to patients with cordiovascular or with neurosyphilis, and more particularly to those with paresis. There is not the slightest evidence to indicate that industrial accidents are more frequently due to the carelessness of syphilitic persons (excluding the two classes named) than to that of nonspyhilitic workers. The routine positive blood test does not establish the diagnosis of cardiovascular or neurosyphilis. These diagnoses can be reached only after complete study of the patient.

The industrial corporations most likely to suffer from serious accidents due to syphilis, e.g., railroads, aviation companies, bus and trucking companies, taxicab companies, do not for the most part require even routine seriologic tests on employment; and, so far as is known, railroad engineers, switchmen, train despatchers, and aviators—all persons responsible for lives of tens or hundreds of others—are in no company required to submit to periodic routine tests.

A routine positive test should not be the criterion for refusal to hire or dismissal. In nonhazardous occupations, the routine positive serologic test deserves no consideration from the standpoint of public safety.

3. The additional economic risk imposed upon the company by industrial compensation or other forms of social insurance is the greatest objection to the employment of syphilitic persons.

So far as is known, there is (except in rare instances) no good evidence to indicate that a syphilitic worker *who does not have cardiovascular or neuraxis involvement* is any more likely (a) to be involved in accidents than his nonspyhilitic brother; or (b) if involved in an accident, to suffer any more serious or prolonged disability; or (c) to suffer more severely from intercurrent nonsyphilitic disease; or even (d) to undergo material shortening of his life span. Whatever risk there may be of any of these eventualities may be largely guarded against (except in cardiovascular or neurosyphilis) by adequate treatment.

The procedure by which an employer can best protect himself against possible loss from syphilis, and at the same time best serve society, is not wholesale refusal to employ syphilitic workers, but individualization in each case.

The employer who comes into possession of important medical knowledge concerning his actual or potential employee, must preserve secrecy. Too often does the fact of syphilitic infection become common knowledge among an office or factory force.

Too often is the unfortunate victim socially ostracized.

There are grave medical and social objections to class discrimination in the use of the routine blood test. The paretic executive is perhaps more likely to do harm to the affairs of the company than the comptometer operator or the common laborer with latent syphilis. If industry is to be consistent in this matter, it will begin the performance of routine serologic tests for syphilis with the president of the company, and will include all executives regardless of age, sex, salary, education, or social position.

There are at least 12,000,000 persons in this country with syphilis. At least half of them have now and will continue to have positive serologic tests of the blood, whether or not adequately treated. Shall they all be refused employment? What of persons with late congenital syphilis, most of whom carry persistently positive blood tests through life, in spite of treatment?

If the syphilitic is refused work, what shall his fate be? The only possible answer seems to be the relief rolls. Are millions of workers to be forced into accepting relief because they have syphilis? If they are, will it cost employers of labor less in taxes to maintain these persons on relief than to handle the problem intelligently and to provide work for those able to perform it?

Summary of "Illinois Assigned Risk Plan, Rejected Risk Plan, Pool Plan." For Workmen's Compensation and Occupational Diseases Insurance—*

TITLE: An Act to provide insurance for employers who have been rejected by carriers respecting coverage under the Workmen's Compensation Act or Workmen's Occupational Diseases Act by assignment of the Industrial Commission and providing for the pooling of losses, and penalties for the violation of this Act.

SECTION 1: Defines the following:

Carrier—Any insurance company or organization writing compensation or occupational diseases insurance.

Compensation Insurance—Refers to insurance under Workmen's Compensation Act.

Occupational Diseases Insurance—Refers to insurance under Workmen's Occupational Diseases Act.

Commission—The Industrial Commission.

SECTION 2: Declares it unlawful for carriers to operate in the State unless they file written acceptance of all provisions of this Act with the State Director of Insurance.

SECTION 3: (a) The Commission, upon finding employer's application for compensation or occupational diseases insurance rejected in writing by three carriers, but otherwise entitled to such insurance, shall designate a carrier which shall be obilgated to issue a standard policy forthwith. The carrier shall not be obligated to issue occupational disease insurance unless authorized by the employer to provide compensation insurance also.

Policies shall contain only usual and customary provisions and shall cover the employer's *entire* liability under both Acts.

No assignment for occupational disease insurance is to be made for an employer who has not filed with the Commission notice of election to pay compensation for occupational disease. (Section 4, Workmen's Occupational Diseases Act.) Assignments are to be distributed equitably among carriers on basis of previous compensation and occupational disease premium volume.

Refusal of a carrier to issue voluntarily a policy for either or both types of insurance at rates reasonably commensurate with the risk may, in the Commission's discretion, be considered a rejection of the employer's application by the carrier.

(b) An employer shall be entitled to insurance provided:

1. He pays the estimated annual premium in advance or makes suitable provisions to pay premiums due.

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* Prepared by CLARKE D. BRIDGES, Director, Workmen's Compensation-Health and Safety Bureau, Illinois Manufacturers' Association, Chicago.

2. He shall have satisfied the Commission that he has complied or will comply substantially with all effective laws, orders, rules and regulations *made by public authorities* for the welfare, health and safety of employees;

3. He, in the opinion of the Commission, shall not be in default of payment of compensation or occupational disease insurance premiums contracted during the year previous.

(c) If the employer is not or ceases to be entitled to insurance, the carrier may cancel insurance in the manner provided in each Act, (Compensation —10 days notice; Occupational Disease—30 days notice), by notice in writing to employer and Commission. The Commission may approve cancellation unless objections by employer are filled within 10 days. Objections shall be heard and decided by Commission within reasonable time and with reasonable notice to all interested parties.

SECTION 4: (a) Losses incurred are to be equitably distributed among all carriers on regular premium volume basis. Two separate reinsurance pools are created. All carriers are required to participate.

"Mutual Pool"—for mutual and reciprocal carriers.

"Stock Pool"—for stock carriers.

(b) A carrier is permitted to insure an employer assigned to another carrier with the approval of the Commission and other members of the pool. Such employer, however, remains subject to the provisions of this Act, and the arrangement does not affect subsequent allotment of assignments.

(c) Reassignments of employers shall be to a carrier which is member of same pool as the original assignment.

(d) At the end of any policy period, a carrier may voluntarily provide insurance for an employer by paying into the pool an amount equal to the excess of the losses over the premiums during the entire period of insurance as an assigned risk.

(e) An assigned employer may not qualify as a self-insurer, although otherwise eligible, except by reimbursing the pool for any excess of losses over premiums during the entire period of assignment.

(f) "Losses" as used in Paragraphs (d) and (e) means losses paid and estimated to be paid. Disputes regarding amounts to be paid and subsequent adjustment of payments originally made under Paragraphs (d) and (e) are to be resolved by the Commission.

(g) Rules and regulations consistent with this section and subject to approval by the Commission are to be adopted by each pool.

SECTION 5: Primary liability of the carrier to pay compensation under either Act is not affected.

SECTION 6: Carriers insuring an employer having employees exposed

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to asbestos, silica, or similar dusts shall inspect and investigate the risk (during the period 7/1/37 to 10/1/38) for the purpose of aiding the Commission in the performance of its duties. Inspections and investigations are to be made within 90 days after issuance of policy, but in any event not later than October 1, 1938. Reports to be made to a central organization or bureau to be designated by the Commission, on forms and in accordance with rules approved by the Commission. One copy of reports to be furnished employer, and only one such inspection and investigation to be made for any one employer.

SECTION 7: Employer is allowed 60 days after the issuance of the policy to appeal to the Commission if premium charge appears unseasonable or discriminatory. Commission may order a hearing of all interested parties and approve the premium or disapprove and instruct the carrier to adjust the rates, which shall be retroactive to the date of the policy.

SECTION 8: This Act does not apply to employers or employees in the coal mining industry.

SECTION 9: Commission required to make and publish rules and orders for carrying out its duties under this Act. Technical and common law rules of evidence shall not apply in hearings of disputes. Commission empowered to administer oaths, examine witnesses, and issue subpoenas.

SECTION 10: In case of refusal or neglect of a Carrier to comply with the provisions of this Act or orders of the Commission pursuant to this Act, the Commission shall, after due notice and hearing, certify such findings to the Director of Insurance who shall suspend the carrier's license to transact *any* business in the state until it has complied.

SECTION 11: Orders of the Commission are subject to review by the Circuit Court in the same manner as provided in the Workmen's Compensation Act.

EFFECTIVE—July 1, 1937.

Dust Hazards and Their Control in Mining

ADVOCATES of health and safety in mining have found themselves confronted in recent years with what might appear to be contradictory procedures with regard to dust occurrence in mines and what appear to be suitable methods or measures to give the mines and mine workers a maximum measure of protection against dust.* A concerted and relatively effective drive has been made to introduce rock dust into bituminous and lignitic coal mines to prevent or limit explosion and fire disasters, while an equally determined effort has been and is now being made to curb rock dust or to eliminate it from air in metal mines to prevent or at least limit the occurrence of miners' consumption and other diseases. Both procedures are logical even though the efforts appear to be of an opposing nature.

While rock dusting has not been applied in coal mines nearly as universally or as effectively as could and should be done, nevertheless a careful analysis of the record of the past 10 years indicates that the amount of rock dusting that has been done has resulted in the saving of a minimum of 200 lives annually—certainly no small achievement. Largely but by no means wholly due to the use of rock dusting, the number of fatalities from explosions and fires in our coal mines in the last four years has been reduced more than 75% as compared with the four-year period 1911-15, the first years of the existence of the United States Bureau of Mines, which was brought into existence in 1910 largely to try to *do something* about reducing the disgracefully high fatality occurrence from explosion disasters in our coal mines. Hence, rock dusting has been given at least a trial and has proved its effectiveness definitely.

The campaign to eliminate or at least to reduce the presence of rock dust in the air of metal mines has been by no means as sensational or as definitely sucessful as has that to introduce rock dust into bituminous and lignitic coal mines; this is due to the difference in the spectacular feature of the results of failure to apply the remedy in taking proper precautions as to air-borne dust in metal mines, as compared with failure in controlling coal-mine dust; failure in controlling dust in certain kinds of coal mines may cause scores of human beings to be hurled into eternity in a few seconds, while failure to handle metal-mine dust conditions adequately works harm on single individuals and usually only after months or years of exposure. Nothwithstanding this lack of spectacular action of air-borne rock dust, there is good reason to believe that since the beginning of the present century more underground workers in the United States have gone to their graves through the breathing of harmful dusts than have been sent there through the more sudden and spectacular instrumentality of exsions or fires. As with the coal-dust-explosion hazard, the remedies are readily available in connection with the other features of dust harmfulness (including breathing it), and organizations that really wish to avoid the various harmful effects of dust occurrence in mines can readily do it.

There are almost innumerable uncertainties connected with the harmfulness of dust, but dust is now generally believed to be detrimental to health through its effect on the throat, bronchial passages, lungs, stomach, and other internal organs as well as on the eyes, ears, nose, and other external organs and the skin covering the entire body. Many dusts (metal, mineral, and organic) are explosive, others fire spontaneously with more or less readiness under varying conditions, and practically all dusts have almost universally detrimental or so-called "nuisance" effects when they settle in the home, in the office, or on the external surfaces of buildings or on the roads, streets, or sidewalks; all of these facts (and almost innumerable others can be added) make dust one of the real scourges of present-day life, and certainly no sane person can deny that a most determined effort should be made to reduce dust or at least to confine it in such manner as to minimize its numerous harmful effects.

It now seems probable that the most harmful of the ordinary dusts to breathe is that of silica, but it must be emphasized that not even free silica (supposedly the most detrimental of the silica dusts) is harmful unless it is breathed in considerable *quantities or concentrations* and over extended periods of time; no human being ever lived any considerable span of years on this earth of ours without breathing silica dust (a large part being free silica), yet this does not mean that all of the people in the world now have or have had silicosis. In other words, the *quantity* of dust taken into the respiratory organs is a controlling factor in dust-respiratory harmfulness, and common sense indicates that the quantity of dust breathed is one of the dominant factors as to possible harmfulness to health from any kind of air-borne dust. What constitutes that quantity limit, no human being knows at this time, notwithstanding the fact that numerous so-called "threshold" limits are now being announced, some of them being embodied in State regulations or laws. Predicting dust-respiratory harmfulness on a sliding scale in proportion to the free-silica content of the dust is anything but logical; in the first place, no one knows whether a dust of 1% silica is or is not more harmful than a dust of 2%, 3% or even 30%. Moreover,

* By D. HARRINGTON, Chief, Health and Safety Branch, U. S. Bureau of Mines, Washington, D. C.; reprinted from U. S. Bureau of Mines Information Circular 6954; presented before the A.I.M.M.E., February 18, 1937.

air with a certain number of dust particles per cubic foot with a silica content of 1% (or any other percentage) would probably be far more harmful to one person than to another or would be far more harmful to a person working at maximum capacity (as when on a contract basis) than to one on a day-pay basis, or more harmful to a person working in an atmosphere of 85° or 90° F. with relative humidity 90 or 95% than to one working in an atmosphere of 60° F. with relative humidity around 60%. There are numerous other more or less similar contributing factors that make unworkable or futile the establishment of regulations as to the allowable number of dust particles on a sliding scale in proportion to silica content of the dust. In some industries, such as metal mining and tunneling, there may be as many different percentages of silica in the mine air as there are places working, and in many metal mines it is entirely unlikely that the percentage of silica in the air of a working place today will be at all like the percentage of silica in that same place tomorrow; to apply to most metal mines the sliding scale of allowable number of dust particles in the air in proportion to silica content would be utterly impossible of enforcement or fulfillment.

Much should be done to clarify numerous uncertainties as to air-dust harmfulness before it is attempted to establish more or less rigid air-dust standards by legal means.

At present there is definite lack of knowledge as to the size of air-borne dust likely to be harmful, and present-day so-called "standards of air dustiness" are built on numerous uncertain premises on this point alone. Different authorities find varying maximum and minimum sizes of dust in lungs of deceased silicotics ranging from as small as 0.2 micron to as large as 10 microns, and from this fact it is deduced that, as far as lung harm is concerned, the dust to be avoided is that from 0.2 to 0.5 micron, on the low side, to six or even as high as 10 microns, on the high side; this leaves much leeway, because an air-dust sample containing 10,000,000 particles 0.5 to six micron size) per cubic foot of air might easily have 30,000,000 particles 0.2 to 10 microns in size Moreover, if the solution theory of dust harmfulness to the lungs is correct, there is the best of reasons to think that particles much smaller than 0.2 micron are very likely to be harmful. And to hold that the only harmful dust sizes are those found in the lungs is anything but good reasoning, because it is a certainty that dusts from 10 microns to 100 or more microns in size when floating in the air are drawn into the nostrils and other protective air passages, and if in large numbers soon clog these protective agencies and passages, giving practically free unobstructed entrance of the so-called "harmful" dusts (say 0.2 to10 micron sizes) into the lungs to perform maximum injury. It does not seem to be logical to disregard these larger sizes entirely, as is now almost universally done in the so-called "dust" standards" being considered and announced. Again, the present-day instruments and methods of sampling air-borne dust and making the determinations as to number of particles present are anything but accurate or definite, even when handled by technically trained experts; and methods or instruments applied to certain industrial conditions are wholly unsuited to others. A condition as to air dustiness found in one sample in a certain place is unlikely to be anything like another sample taken immediately afterwards in the same place and in the same manner; this is true where the sampling is done instantaneously by a grab method or over a period of several minutes. In other words, the technic as to quantity particle determinations in air dustiness is by no means definite, accurate, fair, or dependable, not only as to conditions as between different plants but even as between different time periods in the same place in any one plant. With all of these as well as numerous other uncertainties as to air-borne dust, it seems to be a travesty on justice to try to embody in laws, and regulations having the force of law, rigid standards as to air dustiness; if quality standards as to air-borne dust are made, they should certainly be labeled tentative; and the technic of taking the air samples and making the particle determinations should be very carefully outlined and enforced, otherwise much injustice can be inflicted through inexperience or the malice of the persons making the determinations.

The remedy for harm to health from dust in mines of today is chiefly twofold: use of water to "kill" the dust, and use of ventilating current of fresh air to remove or dilute air dustiness where it is not feasible to "kill" the dust by water. In metal mines, no drilling of any kind should be allowed without simultaneous use of water, and the water should be under pressure and forced through the drill steel so as to "kill" the dust as it is being formed at the face of the drill hole. Many mines resist this practice because of expense of wet-drilling equipment and of placing and maintaining water lines and water at all working faces; miners resist because they hate to do anything they have not been accustomed to doing, because the use of water entails new responsibilities, and because the water tends to wet the clothing. Many other reasons are given by owners as well as by miners why wet drilling cannot be done, but in at least nine out of 10 mines wet drilling can and should be insisted upon.

Blasting should be done after the working shift instead of during the shift, as it has been found that next to dry drilling blasting is the worst present-day producer of dust in air

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in sizes and concentrations likely to be harmful to those who breathe it. Moreover, there is good reason to suspect that the gases porduced in blasting have a rather serious, harmful effect on those who breathe fine dusts, due to inflammation of the respiratory organs by the breathing of those gases even in relatively minute proportions. Various available adjuncts to blasting, such as water blasts or curtains, mist projectors, etc., as well as frequent wetting of the muck piles after blasting and of the face region before blasting are now required and utilized by careful mine operators, even when blasting is done at the end of the shift or on the off-shift.

In coal mines, the mining machines should be equipped with water spray, and to be really effective the water should be piped to the face and be under pressure; here, again, the operator says it is impracticable, expensive, etc., but the answer is that water lines are being kept at working faces in extensive, up-to-date coal mines in several States and at a large number of faces in many metal mines, also. Water should be used on the drilling machines in metal mines and on the mining machines in coal mines, and if piped to the faces, can and should be used by the worker to wet down the broken rock or coal, together with surrounding walls, timber, floor, etc., where dust would otherwise accumulate; this is being done now in numerous mines in several States. It is due largely to the much better ventilation of coal mines than of metal mines that coal miners are less afflicted by dust disease than are metal miners. It is also due to some extent to the better ventilation of coal mines that it is feasible to introduce rock dust into coal mines to prevent or limit explosions and fires and yet not unduly endanger the health of workers, because currents of fresh air remove floating particles of dust and few, if any, dusts that occur in coal or metal mines are harmful to health unless they are present fairly continuously in finely divided form and in large amounts in air breathed by workers through the working shift.

The general, although not universal, practice in some coal-mining regions (and a good health and safety

practice) demands use of water at working faces to "kill" dust as it is being formed and rock dusting of the open parts of the mines away from the faces. Most mines rely very little on the use of water, and where rock dust is used the intent is to carry rock dusting virtually to the faces; this rock dusting to the face appears to be poor policy (unless water is obtainable), as it introduces additional dust at the faces where about 95% of the dust in coal mines is formed, thus adding rock dust to the already coal-dust-impregnated air at working faces; this is likely ultimately to bring about a very serious health problem as well as to decrease visibility very greatly, as dust in the air of coal-mining places reduces visibility 50 or more percent—a decidedly dangerous factor from a safety viewpoint, even if one should disregard considerations as to health or as to dust explosibility. Moreover, cutting coal dry throws quantities of very fine coal dust into the air, which settles later on surrounding surfaces; blasting and shoveling also throw much fine dust into the air, later to settle on walls, timbers, roof, and if 1 or 2% of methane (explosive gas) is present, there must, in some cases, be 80% or more of rock dust (almost impossible to maintain) to prevent ignition of the coal dust of some of our coal mines.

THIS article treats only lightly of dust hazards and has been confined chiefly to dust explosibility and to respiratory disease and almost wholly to lung affections; it gives little or no consideration to the numerous ill effects on human organs other than the lungs due to breathing more or less insoluble dust, or the harm to other internal organs (stomach, liver, kidneys, etc.), or to the nose, throat, and bronchial tubes from breathing more or less soluble or so-called "poisonous" dusts; nor does it take into consideration the numerous hazards to human beings in the breathing of organic dusts, with accompanying hay fever and kindred ills. Moreover, numerous dusts, both organic and inorganic, have harmful influences of various kinds on eyes, ears, and other parts of the body, and on the skin from external contact; and some dusts cause harm to health by being absorbed through the skin. Hence, while pulmonary disease due to the breathing of air-borne dust is unquestionably of great present-day importance, its various ramifications (pneumoconiosis, silicosis, anthracosis, or these combined with tuberculosis), while vitally important, constitute by no means the only detrimental effect to human beings in coming in contact with dust.

A close analysis of the status of dust in industry (and in general life outside of industry also) indicates that numerous, one might almost say innumerable, uncertainties still exist as to specific features connected with dust harmfulness, and so numerous and far reaching are these uncertainties (only a few of which have been indicated in this paper) that almost the only definite fact now available is that dust is a menace and all kinds of it likely to come in contact with human beings should be reduced to a minimum or at least be held under positive control until such time as much well-planned, well correlated research and investigative work (field and laboratory) has been done on almost every phase of the subject of dust, and much additional information has been obtained as to harmful as well as so-called "harmless" dusts.

Numerous clear-thinking persons who have made a minute, comparatively long-time study of dust harmfulness are now expressing the view that much remains unknown as to the health harm from dust, and that about the only safe procedure is to take all reasonable measures to reduce air dustiness where men must work or live. Philip Drinker, as Chairman of a Committee on Preventive Engineering in connection with air dustiness, is quoted as follows:[1]

"There is no satisfactory medical answer at present to this question, but the engineer is making a bad mistake if he lets men breathe heavy dust concentrations of any material. If no other reason for dust control can be found, then one should read transcrips of some of the recent suits at common law, in which fantastic damages for alleged silicosis were granted to men who breathed dust containing little or no silica. The courts and compensation boards are not impressed with subtle distinctions between dusts with 10% and 40% quartz, especially when medical experts are reluctant to make definite statements as to the comparative significance of such differences.

'It would be well to realize that men working in dusty trades suffer far more from respiratory troubles of all kinds than do men who work in clean air. The evidence that excessive dustiness of any kind is harmful is beyond argument."

The *Colliery Guardian*, probably the leading technical coal-mining magazine in Great Britain, had an editorial on "The Removal of Dust," the introductory paragraphs reading:[2]

"The British Colliery Owners' Research Association has shown much wisdom in selecting for attack that front of the dust problem which is concerned with the causation of dust in mines and its dispersal. For the time being, the duty of ascertaining the character of the dusts that may be classed as dangerous to the worker must be left to the geologist and pathologist, and to the medical men the difficult questions involved in the treatment of the diseases from dust.

"From the standpoint of those diseases, it is necessary, of course, to accept certain criteria which have been laid down by the pathologists and have been tentatively adopted by the law-givers, but the dust problem extends considerably beyond the limits of those definitions, for we may account dust as a nuisance irrespective of its influence upon health and as a predisposing cause of chest ailments, and it constitutes, as we all know, a grave danger to the mine worker on account of its explosive character. So that the mine manager is disposed to regard with favour any means within reason of reducing the quantity of dust in the workings, irrespective of its character, instead of attempting meticulous eliminations of the more dangerous elements."

These are sensible statements made by thinking people, and wise mine-operating officials of the present and of the future will be far less inclined to split hairs as to what constitutes a harmful dust and concentrate their faculies and abilities on the feasible methods of handling the dust hazard so it will be reduced to a minimum in the property and as applied to the employees.

1. In Safety Engineering for December 1936 (vol. 72, No. 6, p. 62).

2. In its issue of October 23, 1936 (vol. 153, No. 3956, p. 777).

Selection?

TWENTY-THREE establishments through the past six years showed a progressively decreasing number of male employees during the years 1931, 1932 and 1933.* In 1934, 1935 and 1936 on the other hand, the number gradually increased. With the increase in the number employed there was a concomitant increase in the sickness rate. The accompanying table contains the data:

Year	Average number of male employees	Annual number of cases per 1,000
1931	125,520	94.0
1932	107,681	95.3
1933	105,128	78.8
1934	122,552	76.3
1935	125,727	82.6
1936	145,916	87.4

It appears that an improvement in economic conditions paralleled an increase in the frequency of sickness. To account for this situation it may be hypothesized that during the depression years there was a general releasing of the older and less physically fit employees which led to a highly selected group in 1933 with necessarily low sickness rates; furthermore, pursuing the same thought, with greater demand for employees in the later years the employed group gradually assumed its earlier complexion together with higher sickness rates. The hypothesis is merely stated; to investigate its validity would require additional data which are not available.

*By Dean K. Brundage, Senior Statistician, Division of Industrial Hygiene, National Institute of Health, in a recent report.